THE MARINE REVIEW

VOL. 45 CLEVELAND FEBRUARY, 1915 NEW YORK No. 2

Meeting of Naval Architects

A Brilliant Gathering of the Society of Naval Architects and Marine Engineers—Homer L. Ferguson's Thoughtful Address at the Annual Dinner

THE twenty-second annual meeting of the Society of Naval Architects and Marine Engineers was held in the Engineering Societies building, New York, on Thursday and Friday, Dec. 10 and 11. Owing to the illness of Col. Robert M. Thompson, president, the meeting was presided over by Stevenson Taylor, past president. The secretary's report indicated that the society had a larger membership than ever before and that its financial condition was excellent. The address of Mr. Taylor as acting president was admirable and the gist of it follows:

"As to the progress during the past year in naval architecture and marine engineering, more particularly the latter, it is interesting to note that the number of commercial sea-going vessels provided with Diesel and other oil engines for motive power has increased somewhat so that now there are one hundred or more, the largest installation being one of 4,000 horsepower with six cylinders on each of two shafts. A much greater development has taken place in the method of propulsion by the system of geared turbines, combining the efficiencies of the high speed turbines with that of the comparatively moderate revolutions of the best propeller wheels. According to the latest report, the number of war, passenger and cargo vessels now built or building with all-geared or part-geared turbine machinery is 126 with a total of about 1,000,000 horsepower. Sixty-two of these vessels with a total of 620,000 horsepower have been ordered during the last year. The horsepower being transmitted through one line of shafting by means of gearing, is now up to 20,000. The electrical propulsion of vessels, strictly an American idea, is progressing and the installation of same in a battleship is contemplated as will be noted from one of the interesting papers presented at this meeting.

The First Submarine

"During the past four months the submarine, the aeroplane, hydroplane and dirigible air ship have proved their importance in time of war.

"It is about 30 years since J. P. Holland designed his first submarine which was constructed by the De Lamater Iron Works, of this city, at the foot of West Thirteenth street. It was cigar-shaped, about 75 feet long and 12 feet diameter in the center, a mere cockle-shell compared to the submarine of this day which the wonderful improvements in motive power have made possible. I well remember seeing this submarine submerged alongside of the wharf, but held by the slings of a derrick to make sure it would come to the surface when required.

"The submarine of the present day is quite a different vessel. There are now under construction large submarines capable of steaming 20 knots on the surface, developing 5,000 horsepower with a combination of boilers with oil fuel and turbine-geared machinery. The two-cycle Diesel engine is also still used for surface running while the storage battery remains the driving power while submerged. The new submarines will encompass a radius of from three to four thousand miles on the surface and from one hundred and twenty to one hundred and fifty miles while submerged.

"The submarine has proven its efficiency for a certain phase of warfare but that it has removed the use of the battleship entirely from the field remains to be seen. Possibly the effect of the submarine may change the construction of battleships and a reduction in the size of the units.

"There has been lately published by Captain Baldwin, a well known American aviator, an interesting article written before but proven correct since the commencement of the war in Europe, clearly showing the great advance abroad in the art of navigating the air, an advance so much beyond that of the United States that one wonders if we are not losing our reputation for foresight, enterprise and ingenuity. This is more remarkable when we remember that the aeroplane was developed and made really successful in this country by two Americans, the Wright brothers, who have not received the same recognition here that they have in England and France.

"The loss of the steamship Titanic, supposedly the finest vessel of the time, in April, 1912, on her first voyage to New York aroused the mari-

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time world, resulting in a call originating in this country for an International Conference on Safety of Life at Sea.

"The convention was held in London, opening Nov. 12, 1913, the text of same being finally signed on Jan. 20, 1914. Germany, Austria, Bohemia and Hungary, Belgium, Denmark, Spain, France, Great Britain, Ireland and the colonies of Australia, Canada and New Zealand, Italy, Norway, The Netherlands, Russia, Sweden and the United States were in all represented by 55 delegates. The President of the United States appointed 10 delegates of whom five are members of this society, though they were not appointed as such. It is a matter of gratification, however, that one of the founders of this society and a distinguished officer and member of the council since its incorporation, Admiral W. L. Capps, was selected by the convention to be chairman of its most important committee, the one on construction. It is needless to say that every member of the delegation worked faithfully to procure the results sought by the convention and to bring into one accord the many varied interests involved.

"It is much to be regretted that the text of the convention was not at once ratified by the United States Senate.

"The one great event of the world, overwhelming all others, is the horrible calamity of the almost universal war in Europe. Several nations are engaged in a conflict never before equalled. Each particular nation disavows all responsibility. The people of each nation involved, if accounts be true, and there seems to be no reason for doubting them, have entered the war with a consecration in itself worthy of admiration. Every one of you has his own opinion of the causes, responsibility and probable outcome, which without doubt may be known for the asking. This being a society devoted to science, it were better to avoid partisanship, but I will venture to say that all will agree with the reported opinion of a prince of a royal family of great renown, that "this war is useless, senseless and unnecessary.'

Preparedness for War

"On our roll of membership are the names of distinguished men from every one of the nations engaged in conflict and to discuss the subject other than from the scientific standpoint would be apt to cause bitter thoughts and remarks which we have no desire to arouse.

"The daily press has published columns from the pens of noted men of affairs on the advisability of preparedness and of unpreparedness for war.

"Without going deeply into these subjects, it would seem that so long as national racial tendencies exist and desires for empire supposedly for the interest of the citizens of each nation, tendencies and desires that develop the consecration and patriotism so pre-eminently shown at present in Europe, just so long will there be battleships, airships, submarines and all of the other dreadful paraphernalia of conflict in which as naval architects and marine engineers we must be interested. The old contest of guns versus armor will be accompanied by the newer conflicts of airships and submarines versus battleships, cruisers, destroyers and the like.

Building Up a Merchant Marine

"We would very much prefer to devote the greater part of our energy, skill and industry in building up a merchant marine worthy of our great country, but until a world agreement can be reached and made absolutely perpetual, to abandon these other implements be they for war or protection against war, this country must have its share and you who design, construct and operate same must keep in touch with their developments and must be able to produce in the future as in the past the best of each class.

"Your president in his address at the 1910 meeting in brief said, 'Some day * * * * the people of this great nation * * * * will realize the supreme importance of having ships and yards in which to build them; will realize that we in deliberately passing to foreigners annually enormous sums which should be earned by our own citizens; and they will come to themselves, will unite on the right course, will demand from their representatives a change from the present condition, and they will get it.'

"He then had no thought of the condition of affairs now existing. The great European war accomplished in one short month what years of debate in and out of congress failed to accomplish. It brought directly to the personal interest of agriculturists and some manufacturers the great need for them of a merchant marine; and over-night almost there was a great demand for American ships which the futile legislation of years past had failed to provide.

"So great has this demand been during the past few months that hasty legislation of various kinds has been proposed, and some enacted.

"The rider to the act of Aug. 12, 1912, passed for the management of the Panama canal and the government of the Panama Zone, permitted under certain conditions the admission of foreign built vessels to American registry for trade with foreign countries.

"No owners of such vessels took advantage of this opportunity to come under the American flag for the simple reason that our other laws and customs compel a much greater cost of operation under the American flag than that of any other nation.

"On Aug. 18, 1914, an amendment to the Panama Canal Act just mentioned was passed changing the conditions of that Act and authorizing the President in his discretion to suspend the provisions regarding the nationality of watch officers and the requirements of survey, inspection and measurement.

"This amendment practically went into effect on Sept. 8, and since that date, the dangers of war have caused ninety-seven vessels of 339,153 gross tonnage to be transferred from foreign to American registry. These vessels, owned by American corporations or individuals, were previously built and operated under foreign flags because of the much less cost of so doing.

"Whether these vessels and others that follow the example will remain under the American flag will naturally depend largely on the laws which will be in force 'when this cruel war is over.'

"The prominent propositions which have yet to be acted upon are the purchase of foreign vessels, some of which are now interned in our own seaports; and the formation of a steamship corporation to operate so-called American ships in the trade of the world; either scheme to be supported entirely or in a great measure by the United States government.

Purchase of Foreign Vessels

"The President of the United States in his message to Congress just convened says 'to correct the many mistakes by which we have discouraged and all but destroyed the Merchant Marine of the country, to retrace the steps by which we have, it seems almost deliberately, withdrawn our flag from the seas would take a long time and involve many detailed items of legislation.' Also in reference to the pending Shipping Bill he says, 'In my judgment such legislation is imperatively needed and cannot wisely be postponed. The government must open these gates of trade and open them wide; open them before it is altogether profitable to open

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them or altogether reasonable to ask private capital to open them at a venture.'

"These words would be very encouraging if they did not indicate government ownership and operation, our experience in which does not make us enthusiastic. Government ownership has not proven better than private enterprise by any means. Those who have used government owned and controlled telephone and railroad systems abroad know how they compare with these systems in the United States.

"In this we have the corroborative opinion of M. Yves Guizot, President of Societe d'Economique Politique and former Minister of Public Works in Paris, who has recently published his views on this subject in 'When and Why Public Ownership Has Failed.'

"I quote a sentence or two. 'Individuals are industrious, productive and economical; but administrative and political groups both national and municipal are wasteful and run the taxpayers into debt.' Again, 'Men in office do this or that as the first consideration according to what will make the broadest appeal to present popular prejudices and sympathies and further expenditures with a certain audacity which please better than those which do not appeal to public imagination.'

"Like American travelers, M. Guizot criticizes such of the railroads in France, Germany, Belgium and Austria as are owned by the governments and shows an advantage to the public in the railroads of these same countries that are operated by private corporations.

"Now government operation of ships can only be performed with a disregard of original cost and the regular overhead charges which must in any event be met.

Building Costs

"The actual cost of building and operating steamers under the United States laws according to published figures is at least forty per cent higher than under the English or German flag, and even more under the flags of some other nations, and if the United States government builds the vessels for our merchant marine, it is certain that the specifications and inspection will make the cost much higher. This great difference cannot be met by earnings and of course there will be no profit. The taxpayers will pay the bill, making such expenditures practically a subsidy in disguise.

"There are difficulties in bringing about re-establishment of a merchant marine so long neglected. The civil war practically destroyed what was then left of American lines to foreign countries, as the capacity of our shipyards was required for naval purposes. At the same time advantage of the change from wood to iron for hulls was taken by those abroad, particularly by English shipbuilders who made great strides forward. Our own country needed all available capital and still needs more for interior development, so shipbuilding has been abandoned by capital for the more profitable railroad building and manufacturing. All manufacturers have been protected and that protection made the cost of all labor and materials used in the building of ships much greater than the cost abroad.

Foreigners Carrying Our Goods

"Our agriculturists, so many of whom are far from sight of the sea, cared nothing for American ships. They have been content to allow foreigners to carry their goods until the foreigners have gotten so far ahead, they will be difficult to overtake in the race. Our standards of living have been raised for everybody, but particularly for those who work for daily or monthly wages. Mechanics of all classes have received great increases in wages.

"These changes in fifty years have combined to cause neglect of an American merchant marine.

"A change in our laws, removing some restrictions and regulations would put the operation of our steamships on the same level as those of foreigners; but the political tendencies of recent years, the evident disposition of legislators to enact class legislation like that of the La Follette seamen's bill, will surely add to the cost of operating vessels already too expensive to compete with foreigners makes such a change improbable. The free ship proposition so boldly advocated has proven an absolute failure. Not one ship came under our flag under that proposition, until as I have previously pointed out the ninety-seven were driven by the European war to come under its protection. All other suggestions have been from time to time defeated or tabled by Congress and for this no one political party can be held responsible.

"Now the fact remains, regardless of those who hold to the contrary, that British supremacy was *started* and has been upheld by subsidies while the United States was busy in other directions and supinely allowed our commerce to be taken over by them and others. The British government has given an example of this by loaning to the Cunard Steamship Co. at 2 per cent interest per annum sufficient money to build the Lusitania and Mauretania, to hold the supremacy of the passenger trade, and to provide vessels for their naval reserve. Germany in twenty-five years has made an enormous advance in her merchant marine. That she would do less to accomplish this result than Great Britain is unbelievable. Japan furnishes another distinguished example of what can be done by a government for its merchant marine.

"We must have a merchant marine. We need hardly revert to the well known instances of our deficiency. Our admirable navy, to be compared to the great navies of the world, must have ships to serve as auxiliaries, as tenders and transports, and as schools for mariners.

"Imagine if you can the United Kingdom's situation during the past few months were she not provided with ample ships most skillfully handled; and what would be even now the condition of our own agriculturists and manufacturers were it not for the ships of other nations, mostly British?

"Our agriculturists and manufacturers must have ships to carry their products to foreign markets, ships under the American flag, for it is truly said 'Trade follows the Flag.'

"Why not follow the examples of other nations? We cannot grant subsidies, that word is *so* objectionable, but we may grant direct aid, based on service, on increased cost of operation due to the high standards set by our own people; the carrying of mails or the need of a naval reserve; by the loan of large sums at low rate of interest; by prefcrential or differential duties; by a combination of these reasons or without any of them but solely for the broader and better reason that our country needs a merchant marine— not any particular section or class,—but the *whole* country and all classes, North and South, East and West."

Endowment Fund

The necessity of creating an endowment fund has long been urged upon the society. A committee was appointed last year to go into the matter thoroughly and the suggestions of the committee were as follows:

Although it is not advisable at this time to press for immediate additional contributions to an endowment fund, a definite beginning should be made and the following procedure is recommended:

(1) That the accumulated funds of the society, at least to the extent of $12,560 now invested in municipal bonds, be immediately set aside as the nucleus of an endowment fund.

(2) That all entrance, life and permanent membership fees, all gifts, bequests, etc., unless otherwise specifically designated, be set aside and invested as a permanent addition to the endowment fund.

(3) That until the endowment

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fund reaches the sum of $25,000, not more than one-half of the annual income from it may be used for the current expenses of the society, and that at least one-half of the said annual income shall be set aside and invested as an addition to the endowment fund.

(4) That after the endowment fund reaches the sum of $25,000, two-thirds of the income therefrom may be used for the current needs of the society, the remaining one-third to be set aside for investment as an addition to the endowment until this fund amounts to $50,000. That thereafter the whole of the income from the endowment fund may be used in such manner as the council may direct, increases in the principal sum thereof to be provided for by investment of all entrance, life and permanent membership fees, etc., as noted in paragraph 2 above.

Alfred Noble Memorial

The following letter was received from the American Society of Civil Engineers in reference to the erection of a suitable memorial to the late Alfred Noble:

At the meeting of the board of direction of the American Society of Civil Engineers, June 2, 1914, the following was adopted unanimously:

WHEREAS, By the death of Alfred Noble the engineering profession in America has lost its most prominent member, and

WHEREAS, Mr. Noble has been connected with this society for 40 years, and has served upon its board of directors for nine years, as director, vice president, president and finally as past president, be it

RESOLVED, That the board of direction of the American Society of Civil Engineers acknowledges the indebtedness of the profession to this wise counselor, and active and tireless worker, who, during his connection with this board and subsequently, gave ungrudgingly and unselfishly so much of his valuable time for the general good, and be it further

RESOLVED, That the board desires to spread upon its records its sense of the profound sorrow in the great loss, not only to the profession of engineering, but to the world, of one who by his strong and intellectual personality, earnestness of purpose, sterling honesty and great heart, has set an example for engineers of the future, and in so doing endeared himself to all with whom he came in contact.

At the same meeting the board considered the advisability of the erection of a permanent memorial to Alfred Noble, and, in the belief that such recognition of the man, of the engineer, and of the profession, will meet with universal approval, decided that such a memorial is desirable, should be inaugurated by this society, and should be on no small scale. It was also decided that the engineers of the world be asked to subscribe to the funds necessary for this purpose, and that the memorial take the form of an appropriate statue to be erected in some suitable location.

It was the view of the board that, inasmuch as Alfred Noble's professional practice was national in character, that he was an adviser of presidents, and consulted on some of the most important engineering work of the country, the capital of the nation is the proper location for such a memorial, and that the congress be requested to provide a suitable site in the city of Washington.

The board set aside the sum of $1,000 as a first subscription towards the necessary funds, and appointed the following committee with power to carry out the project:

Onward Bates, Chicago, Ill., chairman.
Robert Moore, St. Louis, Mo.
Samuel Rea, Philadelphia, Pa.
Samuel H. Hedges, Seattle, Wash.
F. H. Newell, Washington, D. C.
Charles Warren Hunt, New York City, secretary.

This committee fully realizes the importance of the duty with which it has been charged, and calls attention to the fact that, notwithstanding the great debt of civilization to the engineer, no dignified and permanent monument in recognition of the work of the profession has as yet been erected in the United States, and to the opportunity which the universal recognition of the pre-eminence of this engineer presents for adequate expression.

The committee desires to enlist your present sympathy in the movement and your future aid in carrying it out by bringing it to the attention of the members of your organization whenever the details have been so far worked out that they may be laid before you.

Yours respectfully,
For the committee.
Charles Warren Hunt, secretary.

Election of Officers and Members

The following election of officers and members occurred:

Vice presidents, term expiring Dec. 31, 1917—W. I. Babcock, W. L. Capps, W. F. Durand, D. W. Taylor.

Executive committee, for ensuing year—Stevenson Taylor, W. L. Capps, Lewis Nixon, W. I. Babcock, Andrew Fletcher.

Secretary-treasurer—Daniel H. Cox.

Committee on papers—W. M. McFarland, W. I. Babcock, F. L. DuBosque.

Members of council, for term expiring Dec. 31, 1917—J. E. Denton, D. H. Cox, H. L. Ferguson, C. H. Peabody, F. L. DuBosque, H. C. Sadler.

Associate members of council, for term expiring Dec. 31, 1917—H. S. Grove, H. L. Aldrich.

Life member—Chief Constructor W. L. Capps, United States navy.

For Members

Albert Allen, surveyor, Lloyds Register, 17 Battery place, N. Y.

Wilmon H. Benson, superintendent hull construction, Newport News Ship Building & Dry Dock Co., Newport News, Va.

Thomas B. F. Benson, naval architect, 205 Yonge street, Toronto, Can.

Manuel I. Bianchi, naval constructor Argentine navy, 97 Butler road, Quincy, Mass.

William H. Blakeman, assistant to general superintendent, Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.

Joseph Barraja-Frauenfelder, chief engineer, Lake Torpedo Boat Co., Bridgeport, Conn.

Charles N. Crowell, general manager, Grand Trunk Pacific Dry Docks & Ship Repair Co., Box 126, Prince Rupert, B. C.

Sloan Danenhower, New York representative, Lake Torpedo Boat Co., 50 Church street, New York.

George A. Dean Jr., general superintendent, Spedden Ship Building Co., 21 W. Franklin street, Baltimore, Md.

Archibald Denny, shipbuilder, Wm. Denny & Bro., Dumbarton, Scotland.

Maurice E. Denny, ship builder, Wm. Denny & Bro., Dumbarton, Scotland.

Harry J. Hartridge, assistant superintending engineer, American Hawaiian Steamship Co., 248 Seventy-eighth street, Brooklyn.

Robert L. Hayne, naval architect, Standard Oil Co., California, 2788 Sacramento street, San Francisco, Cal.

Charles J. Hudson, surveyor, Lloyds Register, 103 Seventy-ninth street, Brooklyn, N. Y.

Joseph W. Isherwood, naval architect, 4 Lloyds avenue, London, E. C.

John Hudson, superintending engineer, United Fruit Co., 404 Sixty-first street, Brooklyn, N. Y.

A. W. Carmichael, assistant naval constructor, U. S. N., Navy Yard, Norfolk, Va.

Norman E. McClelland, surveyor,

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Lloyds Register, 17 Battery place, N. Y.

Phillip L. Miller, general manager, Canadian Vickers Co., Ltd., Longue Pointe, Montreal.

Robert W. Morrell, assistant superintendent Atlantic Basin Iron Works, 39 Water street, New York.

Herbert N. Perham, lieutenant, United States revenue cutter service, Seneca, Tompkinsville, N. Y.

Edward S. Robinson, erecting department, Westinghouse Machine Co., East Pittsburgh, Pa.

George B. Turnbull, chief engineer, Great Lakes Engineering Works, Detroit, Mich.

Joseph J. Tynan, vice president, Union Iron Works, San Francisco, Cal.

George B. Ward, draftsman, chief engineer's office, Panama canal, Cristobal, canal zone.

James C. Workman, chief engineer, American Ship Building Co., Cleveland, O.

Henry B. Oatley, chief engineer, Locomotive Superheater Co., 30 Church street, New York.

Nicholas J. Pluymert Jr., naval architect, Standard Oil Co., 26 Broadway, New York.

Transfer Associate to Member

Martin L. Katzenstein, manager, marine department, International Steam Pump Co., 115 Broadway, New York.

James H. B. MacKenzie, consulting engineer, 24 Stone street, New York.

Transfer Junior to Member

Ralph T. Hanson, assistant naval constructor, U. S. N., navy yard, Charleston, S. C.

For Associates

John H. Bernhard, 244 West 104th street, New York.

Henry E. Caband, general agent, New York & Cuba Mail Steamship Co., pier 14, East river, New York.

Edward R. Grabow, general manager, United Fruit Co., 33 Commonwealth avenue, Boston, Mass.

Henry Reuterdahl, marine artist.

John E. Russell, president, Thor Iron Works, Ltd., Toronto, Can.

Bryant R. Smith, ship draftsman, navy yard, Mare Island, Cal.

Charles L. Cook, president, C. Lee Cook Mfg. Co., Louisville, Ky.

For Juniors

Prentiss Lingman, draftsman, Lake Torpedo Boat Co., Bridgeport, Conn.

J. Herbert Todd, student, Stevens Institute, address, 139 Rutland road, Brooklyn, N. Y.

Tsin Yuan, student, naval architecture, 99 St. Botolph street, Boston.

The annual dinner of the society was held in the Astor Gallery of the Waldorf-Astoria, on Friday evening, and was more liberally attended than any gathering of recent years. Stevenson Taylor presided. The first address was made by Admiral Usher, at present in charge of the Brooklyn navy yard. He was followed by R. A. C. Smith, commissioner of yards and docks of the city of New York. He stated that the first appropriation for the development of New York harbor was made in 1852. This was for $20,000. In 1874 a further appropriation of $5,400,000 was made, not all of which has as yet been expended. Notwithstanding the fact that New York is the principal port of the United States only 2 per cent of the monies appropriated by the government for the development of rivers and harbors has been expended on the port of New York.

Ferguson's Remarks

Harvey D. Goulder, of Cleveland, devoted most of his remarks to the amazing growth of commerce on the lakes and to the fact that by reason of intelligent development of channels the cost of transportation on the lakes was the lowest in the world and that the whole country had benefited from it.

Rear Admiral Washington L. Capps outlined what the International Conference on Safety at Sea had accomplished.

The most striking address of all was made by Homer L. Ferguson, president of the Newport News Ship Building & Dry Dock Co. He declared ship building to be the most dignified of all constructive professions. He then picked up point by point all of the legislative measures that had been presented to congress for the development of the American merchant marine and how they had all been practically rendered inoperative later on. First of all was the reservation of trade with the Philippines to American ships, which was waived for two years before it had a chance to go into operation and was then waived for another two years and then waived forever. Then came the recognition of the right of American coasting vessels to the free use of the Panama canal and then the revocation of that right before the canal became a navigable waterway. He declared that the provision denying the use of the canal to railroad ships had cost the ship yards of this country millions of dollars.

"Some of us had an idea," he said, "that being an American canal we had the right to use it for our own ships."

He pointed out that the ships of the Canadian Pacific railway will undoubtedly use the canal. He also showed clearly how impossible it was to reconcile an eight-hour day on warship construction with merchant construction on an adjoining berth. It practically puts the whole yard on an eight-hour basis and it is, therefore, not surprising that it costs more to build merchant ships in this country than it does abroad. He felt that the bill to create a government-owned steamship line had thrust the biggest possible problem upon the country. He said that every privately owned ship that visits a foreign port runs into difficulties with the foreign authorities that are practically inseparable from the business. Nothing, however, happens because the dispute is purely that of a private individual with a foreign government. If the ship is government-owned, however, it becomes a government matter with the possibility of international complications springing up. He felt that this country had done a lot of talking on behalf of the American merchant marine without being willing at any time to pay for it. He said that discriminating duty is a piecework proposition, whereas a subsidy is general in its application and he was in favor of giving discriminating duties a trial. He declared that it took years to build a warship and more years yet to build a man capable of building a warship. He declared that it is absolutely necessary that the United States should build not only its own warships, but its merchant ships as well. He pointed to the pitiful plight of Turkey, with its purchased navy, and to the undisputed supremacy of England as a ship building nation. He said that as a ship builder the Britisher is very much alive and that this country has a lot to learn from him. A ship is a hand-made proposition and the manufactured articles that enter into it are infinitesimal.

President Taylor declared that Mr. Ferguson's address was the most thoughtful that had ever been made before the society.

The dinner was brought to a conclusion with a few remarks by J. W. Powell, of the Fore River Ship Building Corporation. Those present were:

Aldrich, H. L.
Ali, C. D.
Allen, A.
Almy, C. F. H.
Almy, D.
Amory, J. J.
Anderson, Capt.
Anderson, L.
Anderson, F.
Andrews, J. R.
Atkins, A. W.
Altendrant, A. L.
Auberty, F.
Buckelew, C. W.
Bakeer, Captain
Ball, A. H.
Barre, Joseph
Bennet, E. C.
Bennet, Captain
Berry, W. T.
Best, George E.
Bickford, R. G.
Binley, Wm. Jr.
Bolen, N. W.
Brown, H. H.
Black, Henry

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Blankenship, J. M.
Burd, Capt. G. E.
Burden, Henry
Brunner, Arnold
Babcock, W. I.
Boillot, A.
Bonnin, L.
Bertholp, Capt.

Carr, Capt. C. A.
Carnes, W. F.
Caswell, B.
Cherry, J. M.
Collins, A.
Cornbrooks, T. M.
Cornet, Gardner
Coykendall, W. E.
Coykendall, S. A. Jr.
Cox, D. H.
Coxe, W. G.
Craig, James, Jr.
Chase, M. S.
Capps, W. L.
Colder, Chas. B.

Dalley, H. B.
Demarest, H. S.
Dixon, H. W.
Donald, Douglass
Donald, J. H.
Doyle, S. H. R.
Drake, M. M.
Du Bosque, F. L.
Dunning, Captain
Davis, H. C.
Donald, James

Emery, J. M.
Emmet, W. L. R.

Ferguson, W.
Folger, A. H.
Fils, Ernest
Fletcher, Andrew
Fletcher, H. N.
Frazer, Persifor Jr.
Ferguson, H. L.

Gardner, J. H.
Gordon, J. R.
Graham, John
Grant, Captain
Goodrich, Albert
Goulder, H. D.

Haig, Robert
Haight, R. S.
Halenbeck, O. L.
Halvorson, Capt.
Haynie, W. R.
Hargrave, A. N.
Hartridge, H. J.
Hebble, A. S.
Herbert, F. D.
Heermsten, George
Holzapfel, A. C.
Holzapfel, A. G.
Hopkins, A. L.
Houghton, Capt.
Howard, D.
Howell, W. N.
Hoyt, C. Sherman
Hudson, C. J.
Hudson, John
Holstead, S. J.

Jack, C. P. M.
Jackson, C.
Jobsen, H.
Jones, H. E.
Jarka, Capt. F.
Jungen, C. W.
Jones, R. C.
Jansson, A. H.

Kotter, J.
Katzenstein, W.
Katzenstein, J.
Katzenstein, M. L.
Kennedy, James
King, R. M.
Kinkaid, J. A.
Kindland, M. G.
Konitzky, H.
Kellogg, J. W.

Lawley, Geo. F.
Laverie, R. H.
Leslie, J. S.
Leslie, S. Inglis
London, W. J. A.
Lundin, A. P.
Lassing, W. A.
Linnard, J. H.

Martin, G. R.
Main, A. M.
Magoun, H. A.
Mancor, J. H.
Marshall, A. F.
Mayo, Clayton
Merrill, A. M.
Miller, Spencer
Martin, F. A.
Mills, B.
Mills, E.
Monteagle, R. C.
Mooney, F. D.
Moore, John
Moran, Joseph
Moran, John A.
Morrell, J. B.
Morrell, A. W.
Morrison, J. H.
Morse, E. P. Jr.
Morse, E. P. Sr.
Munn, H. A.
Murray, Mr.
Marriner, R.
Moynhan, M. J.

McAllister, Capt. C. A.
McComb, S. D.
McClelland, N. E.
McCalder, Capt. E. P.
McFarland, W. N.
McGarvey, A. J.
McGrath, Capt.
McIllvain, E. M.

Newton, Samuel
Nivch, T.
Noaks, T.
Noaks, N. B.
Nichols, J. F.
Norden, C. L.

Orbanowski, Kurt

Patterson, F.
Payne, I. L.
Palen, F. P.
Peabody, E. H.
Platt, John
Plummer, James
Pluymert, N. J.
Porter, Capt. W. B.
Palmer, N. F.
Palmer, C. O.
Powell, J. W.

Quackenbos, L. H.

Raymond, H. H.
Richardson, L. C.
Rogers, W. S.
Robinson, G. J.
Rogers, Fred'k
Ruprecht, L.
Robson, J. R.
Ross, C. E.
Rowland, T. F. Jr.
Rowland, C. P.
Row, R. R.
Robinson, S. M.
Rothe, L.

Schmitt, G.
Sadtler, E. B.
Scholz, R. C.
Shields, John
Shentelberry, Chas.
Slechta, J. J.
Slocum, F. B.
Stultz, R. H.
Smith, W. J.
Smith, Capt.
Smith, W. A. F.
Stein, H. H.
Stevens, E. A. Jr.
Stewart, C. P.
Straat, Mr.
Stuart, Linden
Sutphen, H. R.
Sadtler, Prof.
Shilhauer, E.
Smith, F. B.
Smith, R. A. C.
Stocker, Robt.
Sperry, E. A.
Shaw, W. L.

Tardy, W. B.
Thayer, H. H. Jr.
Taylor, G. P.
Thayer, Rodney
Thomas, Mr.
Thompson, W. A. Jr.
Tibbals, G. A.
Todd, W. H.
Tomlinson, Mr.
Taylor, S. P.
Turnbull, J. K.
Tawresey, J. S.

Usher, Admiral

Vail, J. D.
Veit, K. A.

Wales, C. M.
Walsh, J.
Warden, D. T.
Warley, H. W.
Wood, Geo. E.
Wheeler, Harry
Whitaker, J. F.
White, W. A.
Whittlesey, H. N.
Wotherspoon, W. A.
William, W. E.
Work, F. L.
Williams, R. D.

Zucker, Peter

Safety of Life at Sea

Two Admirable Papers by Eugene Tyler Chamberlain and James Donald Are Exhaustively Discussed—Admiral Capps' Illuminating Remarks

THE first paper read was by Eugene Tyler Chamberlain on "The International Conference of Safety at Sea," which was published in full in the January MARINE REVIEW. This was followed by James Donald's paper on "Safety of Life at Sea —Application of Subdivision Rules Adopted at International Conference." Both of these papers were discussed jointly and Mr. Donald's is abstracted as follows:

The conclusions of the International Conference on Safety of Life at Sea which met at London from Nov. 12, 1913, to Jan. 20, 1914, are contained in Senate Document No. 463, Sixty-third Congress, second session.

This paper deals with the subject of subdivision of United States vessels according to the requirements included in Senate Document No. 463.

From the information hereafter it will be seen that the vessels affected by the International Convention are only passenger steamers engaged in the foreign trade of the United States.

United States vessels trading between ports on the Atlantic Coast and in the Gulf, between any Pacific coast ports, between any United States port and Alaska, Hawaii or Porto Rico, or vessels on the Great Lakes would not be affected. The convention rules do not apply to freight steamers.

The arrangements of existing steamers in the foreign trade will be considered by the administration and alterations made with a view to make them conform to the convention requirements.

New vessels for the foreign trade, built after July 1, 1915, will conform to the convention rules.

As so few United States vessels would be affected by the convention it has not been considered of sufficient interest to give any examples of the application of the rules to vessels engaged in the foreign trade.

It seems advisable to legislate for increased safety in vessels engaged in the coastwise trade as it would be very inconsistent to have two different sets of regulations for vessels engaged in equally dangerous trade routes.

A copy of the rules relating to construction and subdivision of steamers as drawn up by the International conference is given herewith, and some remarks are made regarding them.

Two examples of coastwise steamers are made the subject of study, and it is found in the case of the typical passenger and freight steamer on the east coast, assuming that the convention rules are applied, that the number of watertight bulkheads would be considerably increased, that a double bottom would be required, and that no doors in watertight bulkheads or in the vessel's side would be fitted below the waterline. As regards the second example it is found that an additional bulkhead is required. Both of these vessels, if arranged according to convention requirements, will founder with any two adjoining compartments flooded.

As a general rule, it may be stated that the convention requires that the spacing of watertight bulkheads in "mixed cargo and passenger" vessels of 571 feet in length and above, and in "passenger" vessels of 489 feet in length and above, will be such that any two adjoining main transverse compartments may be flooded without resultant foundering. Vessels of less than the above will be able to float with any one compartment flooded without resultant foundering.

It is recommended that the department of commerce consider the safety of life at sea as applied to coastwise steamers, that statutory load line legislation should be enacted, and that the convention rules should be amplified by the addition of curves of floodable lengths for typical steamers and a detailed definition given of the "criterion of service" in Regulation Article VIII.

The Two Papers Discussed

PROF. HERBERT C. SADLER: I think as naval architects and marine engineers we all welcome the results of the work of the International conference. There

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are one or two sentences in the first paper to which I think particular attention should be called. As individuals, some of us have been called in in consultation in connection with legislation, but as a society, as a whole, we perhaps have not received the recognition that we should had had in the past. Beginning on the bottom of page 5 of the first paper, Mr. Chamberlain makes a suggestion which looks to me like a step in the right direction. He says: "Casual study of the 12 articles on construction, comprising Chapter IV of the convention, and the accompanying nine pages of regulations, will convince any reader that a small staff of well trained naval architects must be created to work in or with the department of commerce, if the United States is to give effect to the convention." I think that is a very good suggestion, and a very helpful one. I think that the profession should be consulted in connection with legislation of this character. There is another sentence, on page 6, which is particularly forceful: The steadying effect of international standards on subjects relating to safety of life at sea is insurance against thoughtless or harmful suggestions of legislation or regulation and attempts to pervert public sentiment to the attainment of selfish ends." I wish to call attention particularly to these two sentences. With the best intention possible, sometimes our legislators are apt to draw wrong conclusions, and a demonstration upon the calm waters of the Potomac River does not necessarily reproduce the conditions of storm on the Atlantic in midwinter.

There is another sentence in the second paper which I would like to correct. On page 10, bottom of the page, it says: "Furthermore, an International conference is to be held at London later this year to consider uniform load lines and deck loads, and Congress has provided for American representation at this conference which will consider more particularly cargo vessel problems." The United States originally provided for a commission to attend the second, and to my mind, perhaps the more important, conference. The members of the society may not be aware that the present Senate refused to appropriate anything towards the expenses for the delegates to this convention before the war broke out. So as it stands at present, the United States will not be represented at the Conference on Load Lines unless some change is made in the legislation on the subject.

Factors of Permeability

WARREN T. BERRY: Mr. J. Howland Gardner, a member of the society, has some remarks to make on this paper by Mr. Donald, and as he was called away he asked me to read them for him, and I will do it.

Discussion by Mr. Gardner

J. HOWLAND GARDNER: I have read with a great deal of interest, Mr. James Donald's paper on the Application of Subdivision Rules, adopted at the International Conference, and I believe that he should be congratulated on this very interesting contribution on this most important subject.

There are one or two questions I would like to ask for my own information, and that is if he used the factors of permeability as outlined by the London conference, in making the calculations. I presume, of course, that this was done. I would also like to ask if he cares to express an opinion as to the practical correctness of these factors. It is interesting to note to what extent the question of bulkhead divisions has been considered by the United States government, although this question has repeatedly been brought to their attention. Our chairman, Mr. Stevenson Taylor, could tell you of repeated efforts on his part to persuade the United States government to adopt proper rules and regulations for proper bulkhead spacing and construction. In the new rules just published, the subject of bulkheads occupies less than one page; rules regarding life preservers occupy two pages, fire apparatus, four and one-half pages; boats and rafts 13 2/3 pages. The rules and regulations are apparently formulated to provide for possible escape in case of disaster rather than the idea of preventing the necessity of escape by proper hull construction. The findings of the London conference do not apply, nor were they ever intended to apply to American coastwise trade. The following was therefore suggested at a recent hearing in Washington:

"A great deal has been said and many pages written on 'safety of life at sea' and yet, the real safety of the vessel with proper arrangement of bulkheads has received only a passing comment. The rules govern the spacing of bulkheads, but are silent in regard to depth except that bulkheads must extend above the deep load line. It is perfectly possible to build a vessel that will in every way comply with these rules and regulations, but she will not float if one principal compartment is open to the sea. The unsinkable ship has yet to be produced, but vessels should be so constructed that they will withstand ordinary collisions. It is not only necessary that they float when one or more of the principal compartments are flooded, but it is quite as important to have the hulls so designed that the vessel will be stable under these conditions. The present government requirements for lifeboats and boat handling gear is a serious problem on many ships. Little attention has been paid by the government to this important question of stability in damaged condition. Vessels built in accordance with the present rules and regulations will sink in from ten to 15 minutes if they meet with even a slight damage. It is only necessary to have a leak in one compartment that exceeds the capacity of the wrecking pumps. The time of foundering of a vessel depends only on the time that it required to fill. One might well ask the question why we have so few marine disasters. It is because the men who own and operate vessels are not satisfied to build in accordance with the government regulations, but they insist on a better arrangement of bulkheads. The saying that one should not criticise unless he is prepared to furnish blueprints for something better, is especially applicable in this place, and I would like to take this opportunity to say that this problem has not yet been satisfactorily solved. The various services in which vessels are engaged makes it necessary to adopt different types of construction, for example, in sound service, no bulkheads are required by law, yet, there is no class of vessels where the problem has been more successfully solved than in this particular line of shipping and there are today no vessels under the American flag better equipped along this line. The very nature of the service gives the designer a chance at bulkhead arrangements that might not be practical in some other line of trade where the problem is more complicated.

"I would, therefore, suggest that a committee be formed to study this very important subject and its application to the American trade. This committee should be composed of representatives of the United States Steamboat Inspection Service, designers, builders and owners. They should prepare rules and regulations governing the construction, location of bulkheads, the height of bulkheads and their relation to the maximum load line. They should further consider the necessity for double bottom construction and the extent to which this should be carried on American vessels. After they have completed this most important problem, they should take up the complete revision of the present rules and regulations of the Steamboat Inspection Service.

No Reflection on the Board

"I do not want the Board of Supervising Inspectors to think that in mak-

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ing these suggestions, I am casting any reflection upon the board, as a matter of fact, designers and owners cannot now agree on what should be required or is necessary, in all cases. It is, therefore, not at all surprising that the present government rules and regulations are inadequate for the present conditions. The art of shipbuilding and designing has made very rapid strides in the last few years, and in order to keep up with this progress, new rules and regulations have been added from time to time; these should be collected and brought up to date. The committee, representing, as it would, all sides of the subject, with the assistance gained by properly conducted hearings, should be in a position to produce results that would be of great value to the entire country."

I wish to take this opportunity to solicit the hearty co-operation of all members of the Society of Naval Architects and Marine Engineers, to the end that we may impress upon the government the necessity of a committee to revise the present rules and regulations, and if I am entirely in order, and I know that the chairman will correct me if I am not, I will make a motion that a committee be appointed by the chair to draw up a resolution, subject to the final approval of this meeting, calling the attention of the proper government official or officials to the necessity of appointing a committee to radically revise the existing rules and regulations of the United States Steamboat Inspection Service.

Discussion by Mr. Capps

CHIEF CONSTRUCTOR WASHINGTON L. CAPPS: I hope the meeting will not be alarmed at my bringing some documents here. I shall not take much time. I had hoped that this important subject would be literally attacked by the members of the society. As one who has had somewhat to do with it, I confess to a certain disappointment that the subject has been handled with so much delicacy. I think this indicates that those who went into it realized that it was a much liver issue than might appear on the surface.

Nothing in ship construction could be more important than the preservation of the buoyancy of vessels in damaged condition. The committee which dealt with this subject at the London conference worked very assiduously. At the very beginning there was very far from being any agreement as to the best means to propose. Three more or less definite schemes had been presented by three of the most important maritime nations, but none of these schemes had been sufficiently developed as to permit definite determination as to its merits and demerits. As the convention proceeded, it became evident that we would have to strike out on new lines, and the main committee on safety of construction was then subdivided, and these sub-committees given specific subjects to consider, with the result that before adjournment of the convention this committee was able to report a definite scheme. Even its most ardent advocates would certainly not claim for it anything approaching perfection. Certain compromises were necessary, but it takes very much more than a casual reading even of the complete report of the convention itself to determine just what are the good points and the weaknesses of the convention that was finally adopted.

I think I am safe in stating that the crux of the question as respects buoyancy under damaged conditions is the permeability assigned to different compartments of the vessel which are subject to different kinds of loading. The convention built up from the labors not only of the original bulkhead committee in the early '90s, but the German experience and the French and British experience, a supplement to the report of the bulkhead committee. It may not be known to many of our membership that the permeability adopted by that committee, whose technical labors were so splendidly directed by the late Prof. Jenkins, was 40 per cent. You will note in the permeabilities adopted by the convention that the lowest was 60 per cent. That was applied to cargo space; machinery space was 80 to 85 per cent, and passenger and other between-deck spaces 95 per cent. All doubled bottoms were allotted 95 per cent. A very brief consideration of that would show how at the very beginning in our calculations we tremendously increased the factor of safety. Permeability used in this sense is the proportion of any space which can be flooded under the conditions assumed in the calculations. That means that in all calculations flowing from the provisions of this convention you must assume that, no matter what your cargo is, 60 per cent of that total space would be flooded, 85 per cent of your machinery space, and 95 per cent of passenger and between-deck spaces.

Most ships at sea are so laden that in very many instances the permeability would be much less than that which is assumed as the basis of these calculations. Therefore, under the specific requirements of the convention, your ship, in most cases, has, as a result of these premises, a safety factor.

There are many individual members of the committee who were not satisfied with the degree of rigor of subdivision finally adopted, but a very little specific calculation will show that the degree of rigor established was distinctly in advance of anything now existing; and I regret deeply to say that, if applied to many of the vessels in this country, would not give very satisfactory results.

Covered a Considerable Area

The convention covered a very considerable area of work, as you know, and while setting as high a standard as they felt it possible to set at that time, provided numerous opportunities in avenues of still further improvement as knowledge was developed. For the benefit of those who at first glance will say that the requirements can be easily exceeded, the convention, after some very illuminating debate, incorporated in the convention an article which not only encourages people to do their very best, that is owners and designers, but provides the machinery by which they can be given on the safety certificate of the vessel a mark of merit or efficiency, as it were; in other words, wherever a particular ship in its subdivision exceeds the requirements laid down by the convention the owner can make claim to the proper governmental department, and by furnishing the necessary proof, can have made on his official safety certificate an entry of the extent by which that particular ship exceeds the requirements imposed by the International Convention.

It is possible that I am speaking a little bit more of the convention rather than the papers which have been read this morning, but the papers of course refer in a general way to the convention and its work. Right here it may be pertinent to suggest that when our volume of proceedings is printed, it may be a very good thing to have printed as an appendix the full text of the convention, so that we may have a permanent record in our transactions of the full text.

Recognized an International Principle

I do not think it necessary to go any further into the detail of the papers submitted, which are largely descriptive and refer specifically to the work of the convention, except to note the abstract of the paper by Mr. Donald, whose preparation has been very admirably done, that in excluding coastwise vessels and the vessels of any country from the provisions of the convention, we simply recognized an international principle, a principle of international law, that we cannot regulate the domestic affairs of other countries, but it was very clearly and pointedly indicated that any country ratifying this convention and thereby insisting

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on certain provisions of safety in their sea passenger traffic, would necessarily be obliged to make these principles sooner or later applicable to their own ships, and if quick action were not taken after ratifying the convention, I feel quite sure that public opinion would force action.

And now just one concluding remark about unsinkability, and in a way the unwisdom of relying too much upon a design rendering a ship unsinkable. The very best endeavor of the naval architect may be nullified by ignorance or neglect on the part of those who operate ships. Many devices are installed on passenger vessels at great expense with the specific purpose of rendering these vessels safer under ordinary conditions of operation. I think it is common in the experience of many of us that these carefully designed devices are often allowed to become inoperative, or are so used as not to be ready for service when the emergency arises. Therefore, in preparing his memorandum giving a synopsis of the work of the convention, the chairman of the committee on safety of construction, with the full consent of the committee, felt impelled to call the attention of the president of the congress to the serious obligation still remaining with those who owned and operated ships to do their utmost to render them safe in the ordinary course of navigation, and the president of the congress put in his final synopsis and address the following communication:

No Claim of Ideals

"It is not claimed that ideals have been attained; indeed, there is always room for improvement and progress. But a good beginning has been made, and it is believed that the spirit shown by the representatives of the various countries participating in the conference affords ample evidence that there will follow, through the instrumentalities provided by the convention, still further developments in ship construction and arrangement which will increase the safety of travel at sea.

"It is well to bear in mind, however, that there can never be absolute safety at sea any more than there can be complete security of travel by land. Even perfection of material, where such is obtainable, must be accompanied by vigilance of personnel and the exercise of careful and prudent seamanship. In fact, we may accept without reservation the absolute accuracy of the following paragraph from the summary of the work of the committee on safety of construction, as given in the closing address of Lord Mersey, the president of the conference:

"'It is important to point out that, even after the most careful attention to all practicable details of design which increase the safety of a vessel at sea, there still remains the possibility of a serious and totally destructive accident. Therefore, it is imperative that those charged with the management of vessels should never relax their vigilance on the supposition that any vessel is unsinkable. On the contrary, they should strive to add to the safety provided by the vessel itself that very great increase in safety which results from prudence, skillful management and navigation'."

Discussion by Theodore Lucas

THEODORE LUCAS: I should like to ask a question in regard to the table on page 8, that perhaps could be explained in connection with the factors under column A. It seems that small ships have a factor of 1.00. Does that indicate that there would be no bulkheads at all in these small vessels, or would that be just exclusive of the bulkheads perhaps at the bow and collision bulkheads and the machinery bulkheads?

It is gratifying to see the interest at the present time that is given to the subdivision of ships. I had the pleasure about 14 years ago to present before this society a paper in which I drew attention to the great lack in that direction, particularly subdivision and also instability. We have recently had an accident upon the St. Lawrence river where the collier Storstad ran into the steamer Empress of Ireland, and the ship heeled over and went down through loss of stability rather than lack of subdivision. It would seem wise that some attention should be given to this question of stability, because it would not be so difficult to establish for the ship certain standards of heeling capacity to which the ship could be measured under different conditions. We note here in these subdivision tables that they do take care of different character and density of cargo. That could be applied as easily to the other and perhaps a reasonable factor will result.

Mr. Gardner suggested that a committee might be appointed from the membership of the society and I mention this matter now because I think the same committee could look into this question also, and I think it certainly would be worthy of attention as much as the question of the subdivision of hulls.

THE CHAIRMAN: In regard to the suggestion contained in Mr. Gardner's discussion, read by Mr. Berry, regarding the appointment of a committee, if it meets with your approval we will let that question be determined by the council. We would not have time to enter into a discussion on that particular subject and it is a matter which might better be taken up by the council. If there is no objection, it will stand in that way.

If there is no further discussion, we will call for the closing by the authors. Mr. Chamberlain is not present, but we will be pleased to hear from Mr. Donald in closing the discussion on his paper.

Mr. Donald's Reply

JAMES DONALD: In regard to Mr. Gardner's inquiry in regard to permeability, I use the rule suggested in the International Conference. We have heard from Admiral Capps as regards the question of permeability as applied to different ships, whether it is suitable or not. I think it is.

I am quite in agreement with Prof. Sadler when he draws attention in the first paper to this small staff of well trained naval architects. I believe instead of going to the trouble and expense of getting up rules for subdivisions, loading lines and seaworthiness of the ship, that if there was such a small staff of trained naval architects, where there are so many different types of vessels, coastwise and oversea, that the designs could be submitted to such a staff which would investigate them thoroughly. The recommendations of such a staff could then be carried out. There might be general rules provided by the authorities in charge of the inspection of steam passenger vessels, but in detail this general staff would have authority to pass upon and approve the subdivision or the arrangement of ships.

Before I left London, about two weeks ago, I had a visit from Naval Constructor Bright, who was associated with Admiral Capps on the commission in London, and he, like Admiral Capps, made a strong point on Article X, the article which took notice of the excess of freeboard owing to the subdivision I would like to include this Article X of the International Convention, so as to complete the paper on subdivision.

I would like to draw the attention of the members to the title of the paper, by saying it is the "Application of Subdivision Rules." I am rather disappointed we have not heard from more of the ship owners and marine superintendents. I thought that some of the examples I took would have brought about some discussion with regard to the coastwise ships that are running now. Perhaps it is a delicate point with the principals and also some of the superintendents, but I thought we would have heard something from the marine superintendents as regards the application of these international rules to coastwist trade.

I thank Admiral Capps for his kind

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remarks about the paper, and I think we all ought to feel very glad about the results of the International Conference as regards construction, the division of which Admiral Capps was chairman, and of which he so carefully and successfully guided the proceedings that we have attained the results that we now see in the paper.

Theodore Lucas asked for an explanation regarding the table on page 8. I drew attention in the paper to the fact—also in the abstract on page 2—that the convention required the spacing of watertight bulkheads in "mixed cargo and passenger" vessels 571 feet in length and above, and in "passenger vessels" 489 feet in length and above. Naturally, as the ships got smaller they reduced the factor. It does not necessarily mean there are to be no bulkheads at all. There would be a collision bulkhead, according to Lloyds or any other similar society, and the ships would be required to have watertight bulkheads at end of the machinery spacing. It does not necessarily mean they have no bulkheads at all. I thank you, very much, gentlemen, for your remarks.

THE CHAIRMAN: I would say further, in regard to the suggestion of Admiral Capps as to the publication of the text of the convention, that it be published with our transactions, that that matter may also be taken up by the council.

I do not know that it will interest you at all, but I happened to be in London shortly after the opening of this convention, and no matter how early I got down to breakfast at the hotel I always found Admiral Capps there, or he came in a minute or two afterwards, and no matter how late at night, or early in the morning, I returned to the hotel, I found Admiral Capps busy with a committee, or occupied in some other work in connection with the conference, and it was apparent that he was working 20 hours out of the 24. We are to be congratulated that we had men like Admiral Capps at work on this convention in London.

If there is no further discussion, I wish to tender to Mr. Chamberlain, the efficient member of the delegation sent from the United States to London, your thanks for his paper, and also to extend our thanks to Mr. Donald for the most excellent paper which he has presented to us.

Safety of Life From Fire

THE third paper read was on "Safety of Life From Fire at Sea", by W. O. Teague, which will be found printed in full in the January MARINE REVIEW. Warren T. Berry opened discussion on it, saying:

The paper just presented contains many statements as facts concerning which there is considerable room for argument. Probably every one interested in vessels recognizes the danger from fire on any of them at any time. It is doubtful, however, if they will grant that passengers on vessels "have little chance between death by fire or drowning."

This statement does not seem to be justified by experience or statistics. Accident insurance companies are in direct touch with statistics covering loss of life or injury to persons, and I think, without exception, allow double indemnities for injuries received on common carriers, of which the passenger vessels of this country form a part, and for injuries received in burning buildings, which certainly does not indicate that "there has been little progress made in safeguarding life from fires". Examples of vessels destroyed by fire from 50 to 300 years ago are in no way comparable with existing types.

Further, in regard to these statistics, the paper shows a loss of life in five years, 1906-1910, inclusive, of 104 lives. The records of the department of commerce and labor do not agree with that. The department of steamboat inspection service keeps statistics covering the loss of life on all inspected vessels, and their records show for a corresponding period 71 lives lost. They also show in the year 1905 three lives were lost. In the period from Jan. 1, 1911, to June 30, 1914, 28 lives lost, or a total loss of 102 persons in ten years, as compared with 104 in five years, as given in the paper.

Fire is an ever present danger on shipboard, as it is everywhere else, but vessels today are not "highly inflammable". The United States laws prohibit or restrict the carrying or use of highly inflammable articles on passenger ships.

The experience of the Volturno, where fire was confined and kept in check so that the 650 odd passengers on board were enabled to stay on board something over 24 hours, would seem to indicate a condition that exists in comparatively few structures on land.

The use of non-combustible material in the construction of a vessel and its fittings is undoubtedly desirable. It has not yet, however, been demonstrated that it is practicable to substitute light steel for wood in all cases.

This question has been thoroughly discussed before this society, and many objections have been raised to the use of steel other than the cost and that a "uniform temperature below decks cannot be readily maintained". The principal objection is that of weight. On a vessel of our sound steamer class 365 feet over all length, the additional weight of steel construction above the main deck, as compared with the present construction, would amount to 450 tons, and it has not been demonstrated that a practical structure of this character can be built at all.

Progress in shipbuilding has shown that a matter of 10 per cent increase in cost, or considerably more than 10 per cent, is not considered prohibitive, if definite and feasible plans for improved structures are presented.

In the construction of the steamers Plymouth and Commonwealth, where fire retardant bulkheads were installed, light steel construction was abandoned in favor of double thickness wooden bulkheads, lined on both sides with plaster board, covered with galvanized iron, as such construction has demonstrated its superiority over light steel.

On these steamers, cargo spaces, immigrant and crew quarters and galleys are lined with galvanized iron, fastened close to the wooden decks and carlines, with the belief that, weight for weight, this construction is better for fire retardant purposes than steel alone.

I agree thoroughly that the automatic sprinkler has been a great conserver of life and property, and believe that eventually it will come into very much more general use on shipboard than it is at present.

One of the principal reasons why it has not, has been the failure of sprinkler engineers to accommodate their systems to the requirements of shipbuilding. It has been a good deal like finding a horse to fit the shoe rather than making the shoe fit the horse.

The New England Steamship Co. have installed sprinkler systems on the steamers Pequonnock, Plymouth,

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Commonwealth, Massachusetts, Bunker Hill and Old Colony. These systems are complete, and in order today on the first three steamers. The ownership of the last three steamers has changed, so I am unable to speak for them.

The additional cost of sprinklers is comparatively small in relation to the entire cost of vessels, but on installations with which I have had to do, the total cost, including pumps and connections, which are a necessary part of the system, has been considerably over $4 per sprinkler—about $7 would be nearer the figure.

The wet pipe system is prohibitive on vessels of the river, sound and similar types because of freezing and the weight of water in the system.

In cargo spaces freight is stowed practically from deck to deck, and on the steamers Pequonnock, Plymouth and Commonwealth there are approximately 100 sprinklers broken off or damaged by cargo every year. With the absolutely automatic systems advocated, the water damage from this cause alone would be immense.

Our experience with the steamer Pequonnock has led to the abandonment of the dry pipe automatic system, with which she was originally fitted, in favor of the manually operated valves.

The effect of automatic systems, in case of collision, where damages occur in passenger quarters, has also been considered, and we have, to date, declined to assume the responsibility of adding to the possibilities of panic by flooding damaged portions of the vessel with water from broken sprinkler pipes or damaged sprinklers.

Gravity Tanks

We have also considered it impracticable and unnecessary to install a gravity tank, as pressure is constantly maintained by a steam pump.

It is hardly conceivable that any one at all familiar with shipbuilding would consider for a moment the placing of a watertank in the form of an extra smokestack, as aside from the total weight to be carried, the weight in this particular form and place would be in the very worst position possible to affect the stability of the vessel. The sprinkler systems on the Pequonnock, Plymouth and Commonwealth are, therefore, arranged to be manually operated.

A thermostat system is arranged in parallel with the sprinkler system to ring alarm bells and register the location of fire on an annunciator in the engine room, where there is at all times an engineer on watch whose duty it is to open the sprinkler system valve. The delay in obtaining water at the sprinklers with this system need not be appreciable.

This brings us, however, to a matter which is probably of the greatest importance—the discipline and training of the crew. It has been my experience that fire and boat drills are fortunately not "usually considered useless wastes of time and effort", but on the contrary, are regarded as a prime essential for the safety of the ship, and I believe that owners and managers of vessels in the United States today are keenly alive to this fact, and, moreover, that officers and crews of American steamers fully appreciate their responsibility in this regard and live up to it.

Sprinklers Aboard Ship

W. D. FORBES: Having had experience in installing sprinklers and testing them, I will say that I do not think the conditions of operation of a sprinkler system aboard ship and on shore are comparable. I agree with Mr. Berry that the panic, which the damage to a water pipe and the flooding of a ship with water might occasion, in times of accident, is a serious handicap. I thoroughly believe that, in the system which is an old one in which an electric indicator shows where there is excessive heat and the use of perforated water pipes controlled by valves in the engine room, may afford infinitely better protection than you can get by any automatic system. A dry pipe system is of very little value in shore work, under most conditions. The real value of the sprinkler is to put out an incipient fire—you can spit on a match which is blazing and put it out. That is the theory of the automatic sprinkler system. In the modern factory and similar buildings, the automatic sprinkler system is of great value, where the water can reach the fire and put it out quickly, but in a cargo vessel, vessels whose holds are filled with boxes and things of that sort, the water is not apt to reach the fire quickly enough to prevent a conflagration. That is the fundamental idea of the sprinkler, to put out the fire quickly. Therefore, the flooding of the compartment is of very great importance.

I had the pleasure of meeting Captain Inch, of the S. S. Volturno, a few days after he arrived in New York, after the burning of his ship, and I spoke to him about sprinklers. He said that no amount of water could possibly stop the conflagration, although it was discovered early, on account of the position of the cargo protecting the fire; but I think, Mr. President, that the automatic sprinkler system is not applicable on board ship, but that the perforated pipe system will always prove more satisfactory.

JOHN A. STEVENS: I wish to be recorded as being heartily in favor of the maximum protection of human life and property at sea by the most complete automatic sprinkler system which can be devised, in both passenger and cargo vessels, and I believe that we have reached a state of civilization where we can demand such protection. Further, most of us are willing to pay the additional price for our transportation which would be necessitated by such an innovation.

I. G. HOAGLAND: It should be remembered that the word "automatic" has a double meaning in the sprinkler system—the device itself is automatic, and in the case of sprinkler systems on land the water supplies are also automatic. The operation of the sprinkler system would be no less automatic on board ship if the water supplies were automatic. The advantage of the automatic system is that the sprinklers find the fire, with enough heads open over the area of the fire, to allow a sufficient discharge of water and thus extinguish the fire. The ordinary method aboard ship of extinguishing a fire is by submersion, flooding the fires, raising the water up to the fire, while the automatic sprinkler will discharge the water above the fire and accomplish the same purpose.

Manual Operation

W. O. TEAGUE: I would like to say a few words regarding two of the matters which Mr. Berry brought out. I am strongly of the opinion that the sprinkler system with a manual operation is highly inefficient, and I think it gives a false sense of security. The great value of the automatic sprinkler is in the fact that it is automatic—the automatic sprinkler was intended, when first originated, to take the place of the "first aid" in fire protection, and that was the fire pail. In factory work the mill operatives know what the fire pail is for, and they know how to use it. During the day the operatives are in the factory, and in case of a fire starting during that time there would probably be very little occasion to have the automatic sprinkler come into play, but fires occur in concealed places during the working hours, and also they are apt to occur during holidays, or Sundays, or nights, when the employees are

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not present. Therefore, to continue the protection something automatic, which would approach the manual operation of fire pails, was developed, and this protection is found in the automatic sprinkler. In order for a fire to be put out by the use of fire pails they must be used promptly while the fire is in the incipient condition, and the same thing is true of the automatic sprinkler. Where the sprinkler is on a system which is ordinarily dry and the operation of it depends on the opening of valves in the pump room, there is bound to be a delay, and that delay, a matter of a few minutes, may be a serious one. For instance, in the case of a steamer similar to the Commonwealth, we have a similar arrangement of woodwork to what we get in a large frame building on land, but we have worse conditions as regards the hazard to life. When the structure is on land, and a fire occurs, the people have a chance to get out, to get on to the adjoining land and get away, but it is not so easy to get away when the building or the steamer is on the water. Of course, life saving appliances, such as lifeboats, life preservers, etc., are at hand, but it has been demonstrated in experience after experience, that the people can not get off the vessels, especially during the night time or when the water is very rough, and also when the crew is not drilled in the use of life saving appliances. In my opinion the installation of such a system as that on board the Commonwealth is a step in the wrong direction. If trouble does come, it will count against the standing of the automatic sprinkler, which it should not do, because the automatic sprinkler in that case is not properly installed for the best efficiency.

Large Passenger Steamers

As to my suggestion that a gravity supply could be arranged for in the large passenger steamers by some such an arrangement as an extra stack, built for use as a gravity tank, of course the placing of water at that height is objectionable, as regards the stability of the vessel, but in my opinion the total weight of that water, as compared with the total weight of the vessel, is almost negligible—

THE CHAIRMAN: What do you consider the total weight of water to be in that case, in the case of a steamer like the Commonwealth, for instance? That is an important point for the naval architect to understand, what would be the least quantity of water you would have in the tank, how many thousand gallons?

W. O. TEAGUE: For a steamer of the Commonwealth type I think we should have 5,000 gallons.

THE CHAIRMAN: That would give about twenty-five tons up in the air —that would be a serious matter.

W. O. TEAGUE: What is the total tonnage?

THE CHAIRMAN: It is not a question of tonnage, it is a question of stability. Pardon me, I want to get you straight on that point, the difference between tonnage and stability.

W. O. TEAGUE: I thank you very much.

Teague's Quick Reply

THE CHAIRMAN: Evidently you do not understand the question of stability. The meeting will kindly forgive me for butting in at this particular point, but it is evident that Mr. Teague, not being a naval architect, does not understand the difference between the tonnage of a vessel and the stability of a vessel, and I would like to put him straight on that question, in order that he may discuss the subject from the standpoint of the naval architect.

W. O. TEAGUE: I think this suggestion is hardly pertinent, since I am a naval architect by training and experience for several years. During my work in fire protection, if I have strayed from the principles and theory of naval architecture, I am not surprised.

The second speaker brought up the point regarding the use of automatic sprinklers and referred to their use on cargo vessels. My paper was intended only to cover passenger steamers, and I have not gone into the matter of cargo vessels at all in this paper. I do wish to bring out the fact strongly that I have not laid claim to the automatic sprinkler as the only means of protection on shipboard. I have tried to bring out the point that the automatic sprinkler is the best form of protection, but in addition to that some value should be placed upon the use of gases and steam. I thank you very much, Mr. Chairman.

THE CHAIRMAN: The question of danger from fire on board of vessels seems to come up perennially in this society, and very properly, too, I suppose, but the remarks of the author of the paper just presented in closing the discussion calls to my mind some figures given at the 1910 meeting as to the danger from fire on board of vessels. I have sent for a copy of the proceedings of the meeting. You will recall that the speaker just said that we have on a steamer like the Commonwealth, for instance, a situation comparable to that of a frame building on shore. In the city of New York, in the borough of Manhattan, particularly, the frame buildings can be counted on the fingers of two hands. They are very far apart. If they exist at all they must be sixty or seventy years old at least, and there are very few of them. The fires which occur in the city of New York are in brick buildings, stone buildings, or buildings of that class. In the years 1908, 1909 and 1910, which, at that time was all the information which could be obtained from the fire department of the city of New York, there were 227 lives lost in the city of New York, that is to say, practically in the borough of Manhattan, while in the same three years on board of steamers there were fifty lives lost only, and of those there were twenty-two lost by explosions either of gasoline or of boilers. I deprecate the constant calling of attention to the great danger from fire on board of vessels. Anything that the naval architects can do to make steam vessels or other vessels safer will be done, I am sure.

On your behalf, I tender the thanks of the society to Mr. Teague for the interest shown in the society by the presentation of this paper, and I trust that the discussion as brought out may contain some matters of interest to you.

On account of the delay of one of its vessels due to the new Culebra slide a steamship company inquired if claims for demurrage would be considered by the government. The governor of the canal zone replied that the Panama canal is not to be held responsible for such delay and added: "It may be of interest to state that the original date for the completion of the canal was Jan. 1, 1915, but that the construction work was so far advanced, though not entirely completed, in August of the current year, that it was decided to offer vessels the privilege of using it before the official opening. When this slide occurred it was considered advisable, as a matter of precaution, to give the dredges and other equipment the right of way for a few days, to engage in construction work, in preference to the vessels that were waiting transit through the canal."

The Newport News Ship Building & Dry Dock Co. has been awarded contract by the Standard Oil Co. for two 550-foot tank steamers.

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Effect Upon Resistance

Papers by Prof. H. C. Sadler and Naval Constructor D. W. Taylor on Model Experiments and Their Conclusions

THE first paper read at the Thursday afternoon session was Prof. H. C. Sadler's paper on "The Expansion or Contraction of Dimensions and the Effect upon Resistance," as follows:

In the preparation of the plans for a new vessel is frequently happens that the designer has at hand the trial data as to speed and power for a vessel, similar, so far as the coefficients of form are concerned, but whose ratios of dimensions are not the same as those of the proposed vessel.

From former experience and results of model tests already published, it may be possible to estimate the effect of change in ratios of dimensions with a fair degree of accuracy, but in order to obtain additional data upon this subject and to bring the results into a more concrete form the following investigations were undertaken:

Three different types of ordinary mercantile forms were designed ranging in longitudinal coefficients at the deepest draught from 0.551 to 0.674. Each model was tested at three different draughts, but the same actual draughts were used in each case.

A number of models of each type were made of varying breadths, by simply expanding or contracting the parent form in this direction only, the length and draught in each case remaining constant.

In a similar manner the length and breadth were held constant and the under-water form changed by varying the distance between the original waterlines only, *i. e.*, expanding or contracting the draught. Also, the breadth and draught were kept constant and a series of models made by expanding or contracting the distance between the transverse stations, *i. e.*, expanding or contracting the length.

Finally, the three forms were tried of the same displacement, breadth and draught, but of different lengths and hence different coefficients of form.

The coefficient of midship section was kept constant throughout the series.

In all of the foregoing, therefore, the displacement for each type was allowed to vary in the same ratio as the variation of the particular dimensions.

The particulars of the three types are given in the following table:

	Type 1.			Type 2.			Type 3.		
Draught.	C_m	C_1	C_b	C_m	C_1	C_b	C_m	C_1	C_b
a.....	0.936	0.674	0.63	0.936	0.606	0.567	0.936	0.551	0.515
b.....	0.92	0.665	0.612	0.92	0.598	0.537	0.92	0.544	0.501
c.....	0.904	0.648	0.585	0.904	0.583	0.526	0.904	0.530	0.479

The varying ratios of length and breadth and draught are shown on the respective curves.

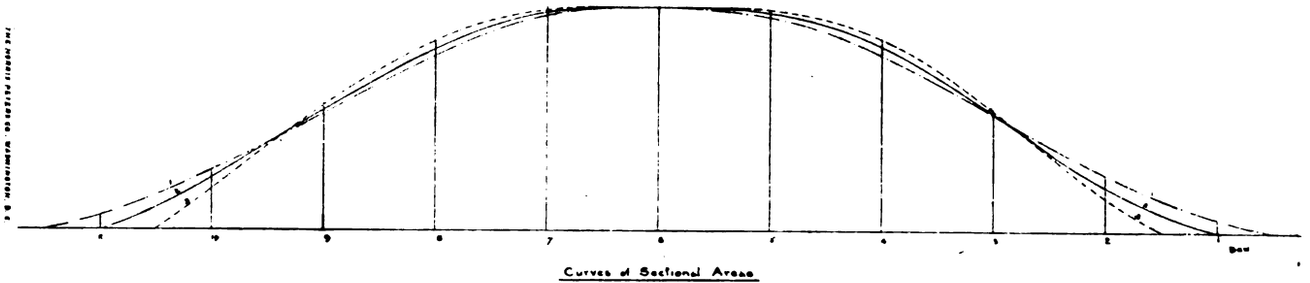
The curves of sectional areas of the parent forms are shown on Plate 1, and represent the three different types of varying length and constant displacement. In presenting the results of the experiments it has been deemed advisable to give them in the form of wave-making resistance per ton of displacement, in terms of speed-length ratio. For any particular case the surface friction is readily calculated, and although when total resistance is considered the results may appear different from those due to wave resistance only, it is the latter which is usually the unknown quantity. The fact that the residuary resistance is obtained by subtracting the frictional from the total resistance, together with possible minor experimental errors, would probably account for certain inconsistences which appeared in the final results. In general, however, within the limits of economical speed for each type, or before the region of the first "hump" in the resistance curve, the results were fairly consistent, and the following curves represent the average variation in each case. Beyond the above speeds the variation in resistance did not seem to follow any simple law but varied somewhat with the speed.

The curves shown in Plate 2 represent in general the variation of residuary resistance per ton of displacement with respect to breadth. They are the results for the medium draught (b) for each type, but the same characteristics were found to hold for the other draughts at which the models were tried.

Within the limits of the variation of breadth shown, the residuary resistance appears to vary as about the 1.65 to the 1.7 power of the breadth, or the residuary resistance per ton of displacement as about the 0.65 to 0.70 power of the breadth, if the lines are simply expanded or contracted and the displacement allowed to vary accordingly.

The effect of variation of draught due to expanding or contracting the dimension in this direction, did not appear to be quite as consistent as in the previous case, but in general the average results are shown in Plate 3. They are for the forms represented by the medium draught (b). Up to the limit of economical speed the residuary resistance varies as about the 0.65 to 0.7 power of the draught. Above these speeds the index gradually increases. The residuary resistance per ton of displacement therefore varies inversely as about the 0.35 to the 0.3 power of the draught.

If length alone is varied, breadth and draught being kept constant, we



Curves of Sectional Areas

PLATE 1

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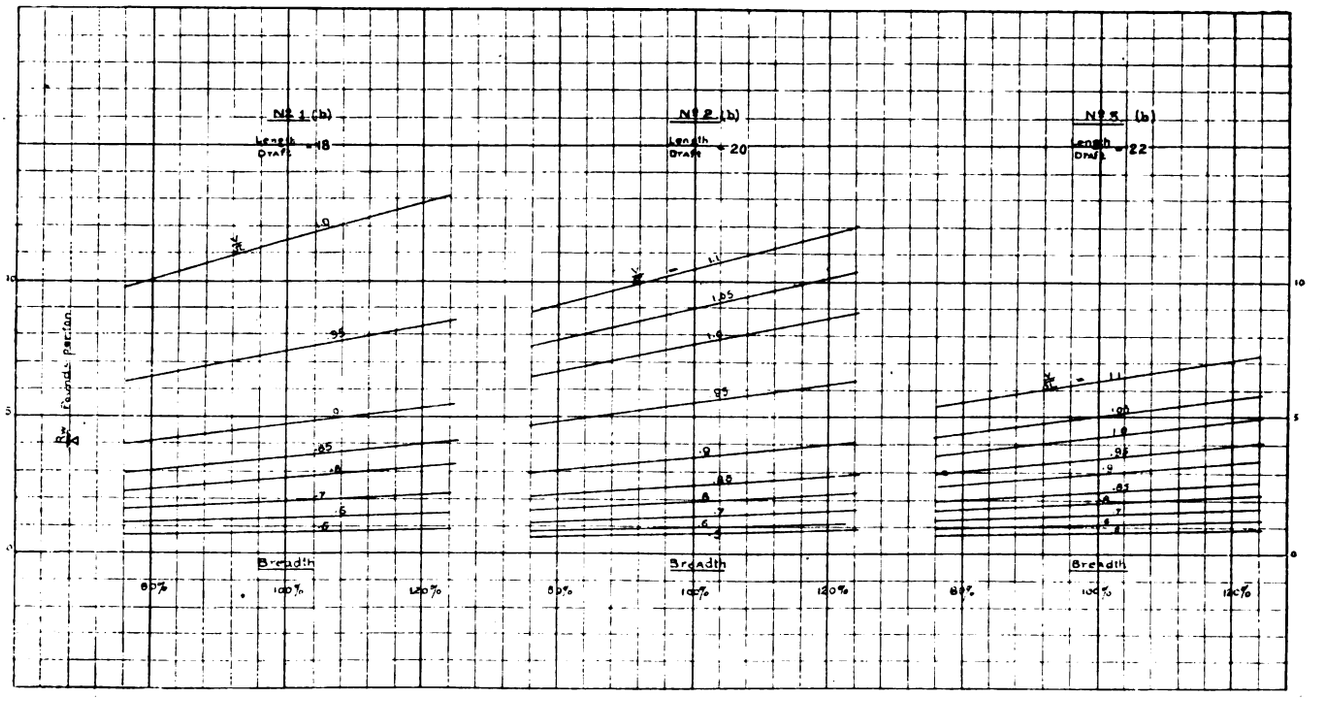

PLATE 2

have simply a combination of the foregoing: for if all dimensions were varied proportionately the residuary resistance per ton of displacement would be constant at constant speed-length ratios. Increasing, say, the length only is therefore equivalent to reducing both breadth and draught of the parent form simultaneously.

As a check upon this, each of the forms was expanded or contracted longitudinally, and the results are shown for the medium draught (b) in Plate 4. If the length be increased, say n times, breadth and draught remaining constant, we obtain a similar form to that of the parent type in which the breadth and draught have each been reduced n times; and therefore if the residuary resistance per ton of displacement at corresponding speeds varies as the 0.7 power of the beam and inversely as the 0.3 power of the draught, the combined result would be that this factor will vary as $n^{.3} \div n^{.7}$ or $\frac{1}{n^{.4}}$. In other words, the residuary resistance per ton at constant speed-length ratio will vary approximately inversely as the "length"$^{0.4}$. An examination of the above curves, Fig. 4, will show that this is practically the case.

As the three original parent forms were made of the same displacement but of different lengths, the effect of influence of length for this particular series could be readily obtained. The curves, Plate 5, show the results for the three different draughts at which the models were tried. They represent constant speed curves for varying lengths with constant beam, draught and displacement, and illustrate the well-known influence of length as affecting residuary resistance. The total resistance curves would not, of course, show such a marked difference, as the longer form, though finer, would have a greater friction than the shorter and fuller form.

Shallow-Draught Types.

In connection with some experiments upon certain types of river steamers such as those of the Mississippi stern-wheel type, occasion was had to determine the effect of variation of breadth only. These are rather extreme types where the ratio of length to draught was from 40 to 50, and the ratio of breadth to draught

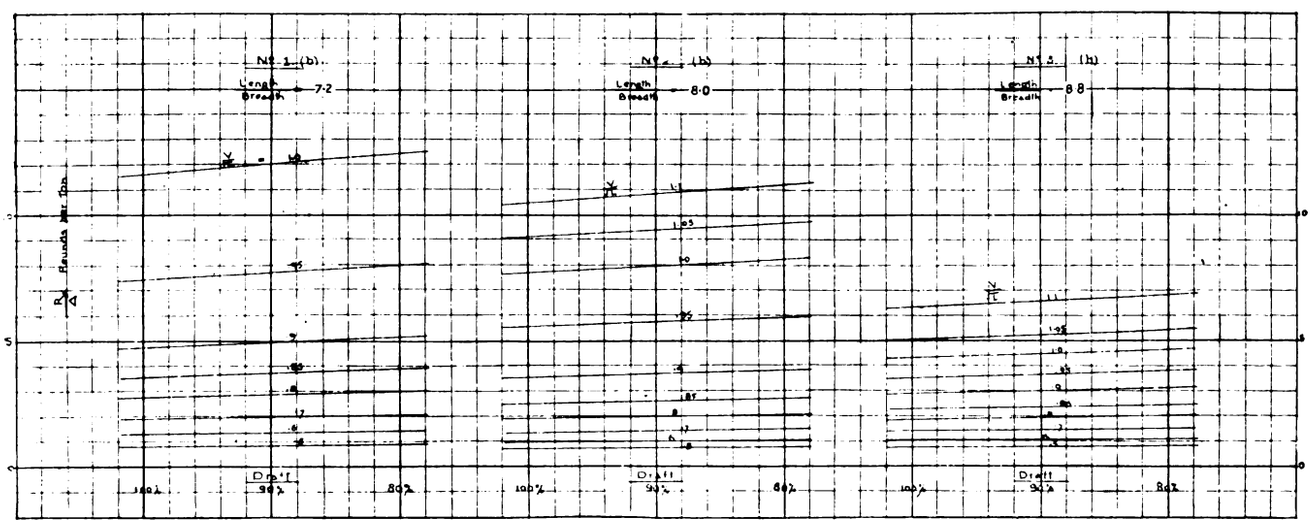

PLATE 3

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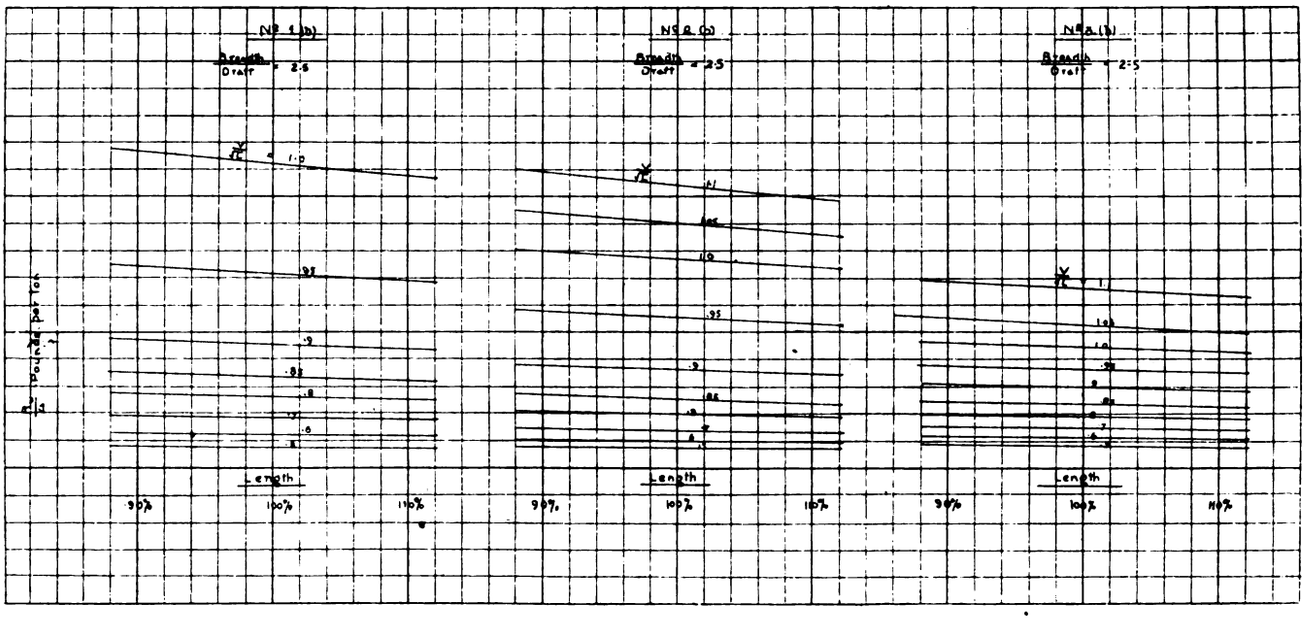

PLATE 4

varied from about 8 to 12. Two different types were tried, the stern in both cases being that usually adopted for the stern-wheel vessel, and the bows either ship-shape or "scow" form.

In these cases the wave-making resistance at corresponding speeds, within the limits of speed at which these vessels would normally be run, appears to vary as about the 0.75 power of the beam, or per ton of displacement inversely as the 0.25 power of the beam.

As the models of the above contained a large percentage of parallel middle body, this part, which represents a practically rectangular form, was also tried at different breadths. The ratio of breadth to draught was the same as for the previous forms, but in this case the residuary resistance appeared to vary directly as the beam, or the residuary resistance per ton of displacement was constant at corresponding speeds.

In conclusion, a word of caution should be given about extending the above results beyond the limits of the experiments, both with regard to dimensions and speed. Within these limits, of, say 20 per cent variation no serious error will be involved if the residuary resistance per ton of displacement at constant speed-length ratios be assumed to vary as about the 0.7 power of the breadth, inversely as the 0.3 power of the draught, and inversely as the 0.4 power of the length; or the residuary resistance be assumed to vary as the 1.7 power of the breadth and as the 0.7 power of the draught, and 0.6 power of the length, for similar normal mercantile types at corresponding speeds.

The results also emphasize the fact

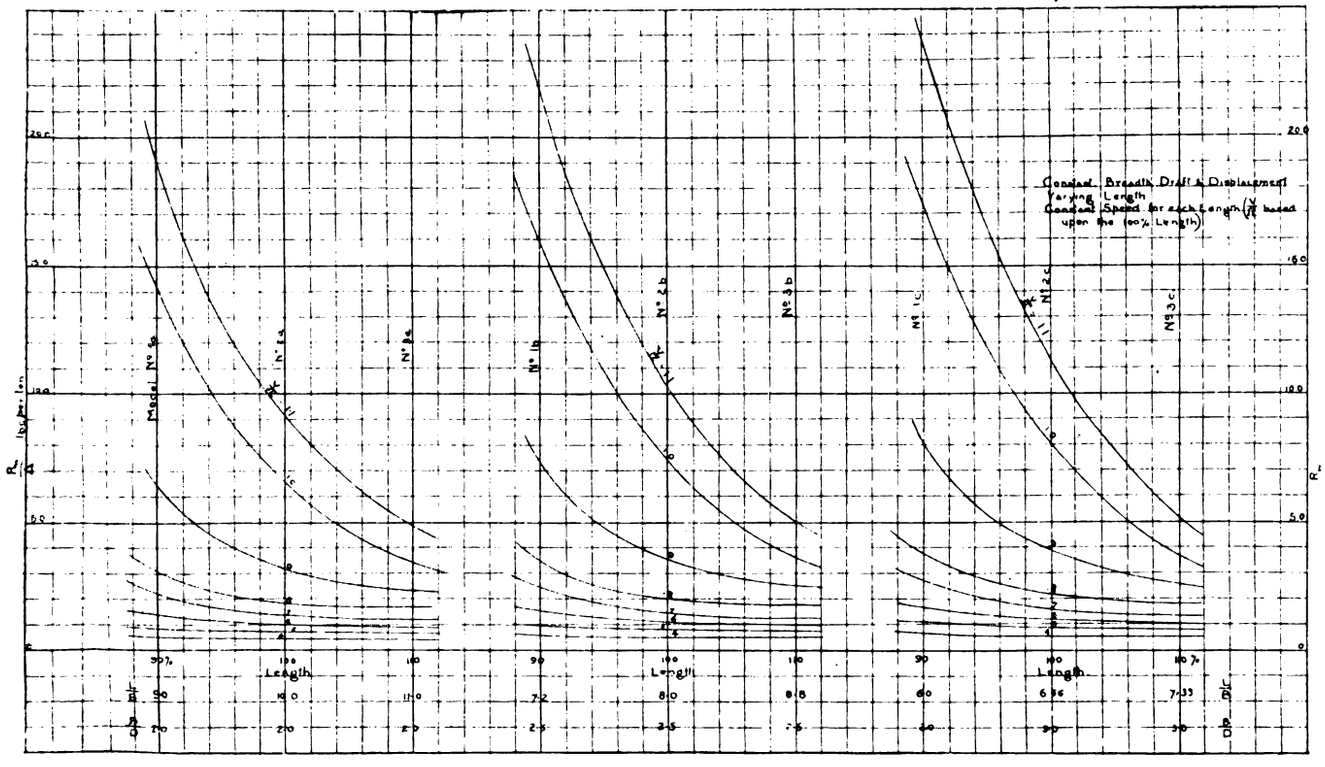

PLATE 5

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that the draught is the more economical dimension to increase, if increased displacement of a given type is desired.

For very wide and shallow forms, however, the influence of breadth upon residuary resistance does not appear to be as marked as in the case of the more normal forms.

D. W. Taylor's paper on "Some Experiments with Models Having Radical Variations of After Sections" was then read. In his paper Mr. Taylor said:

When we determine the form of a ship there are two things which must be done in connection with every station or section. We must, by some means, fix the area and then determine the form or shape to be given the section having the given area. Taking ships as they are, for given dimensions and displacement there is not room for very large optional variations of sectional area except near the extremities. The designer has a fairly free hand, however, when it comes to the shapes of the sections, particularly toward the extremities.

There are, of course, matters to be considered in connection with these shapes other than the question of resistance, such as seaworthiness, carrying capacity, etc., but it should be understood that in this paper questions of resistance only are taken up. Broadly speaking, as regards the shapes of sections, the accepted practice is to approach the U-type forward and the V-type aft. From our experience at the U. S. Model Basin this practice, as regards resistance, would appear fully justified as to the bow, the U-type of section being nearly always desirable forward. Moreover, the resistance seems to be more affected by changes forward than by the changes aft, or, to put it in another way, to depend more upon the forward form than upon the after form.

Systematic variations of form of entrance generally result in systematically varying resistance and allow definite conclusions to be drawn. When it comes to the run, however, we find it much harder to draw definite conclusions. Changes in the form of the after sections appear to affect the resistance less than do changes forward, and changes of resistance for systematic changes of after form are not always systematic. So, while we feel that the standard practice is probably right and that V-sections aft are desirable from the point of view of resistance, we do not feel that here we are upon such firm ground as with regard to the U-sections forward.

In view of the difficulty of obtaining definite characteristic results from comparatively small changes of shape aft, we have recently made some experiments with after forms of radically differing shapes, and it is the object of this paper to put before the society the results obtained. Six after bodies were tested for resistance, all with the same fore body and all having the same curve of sectional areas. All models were 20 feet long in accordance with the standard practice at the U. S. Model Basin. The beam was 1.828 feet; draught, 1.179 feet; displacement, 2,500 pounds in fresh water; midship section coefficient, 0.98; longitudinal coefficient, 0.6122; block coefficient, 0.60.

Fig. 1, Plate 1, shows the original lines, including stern *A* and the curve of sectional areas for all models. This was one of the models tested last year, the results being included in my paper of last year on "Relative Resistances of Some Models with Block Coefficient Constant and Other Coefficients Varied". Sterns *B*, *C*, *D*, *E* and *F* are shown in Figs. 2, 3, 4, 5 and 6, Plate 2. Fig. 7, Plate 3, shows the curves of total resistance and the estimated wetted surface resistances, and Fig. 8, Plate 4, shows the residuary resistances.

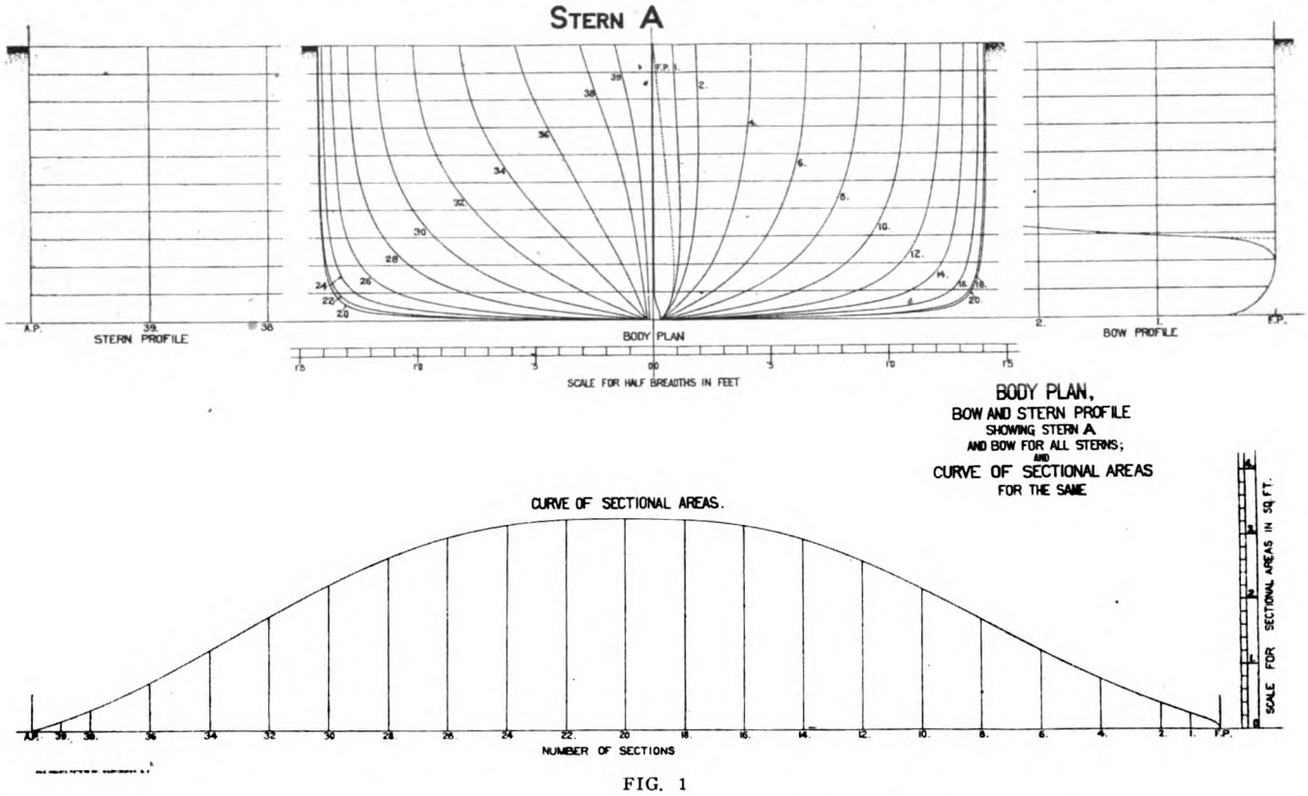

FIG. 1

The underlying idea of stern *B* was a shape which would start the water up more quickly than in the standard type. The idea of stern C was to carry right aft sections derived from the midship section (98 per cent coefficient) beam only being decreased; in other words, to make a wall-sided model. Stern *D* was stern *C* disposed horizontally instead of vertically. The beam was kept constant and draught only was changed, as we went aft, the sections having 98 per cent co-

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efficient. In other words, stern *D* was an exaggeration of the flat-stern type. Stern *E* was a combination of sterns *C* and *D*, the attempt being made to combine them half and half, as it were, and coax the water up along a bilge diagonal. In stern *F* not only was the coefficient 0.98 retained for all sections, but they were made geometrically similar to the midship section, beam and draught both being decreased as necessary to obtain the required area. For sterns *C*, *D* and *F* the sectional coefficient is constant—0.98, as already stated.

Fig. 9, Plate 5, shows how this constant sectional coefficient contrasts with the curves of sectional coefficient of *A*, *B* and *E*. It is typical of V-sections that the sectional coefficients as below 0.5, but when we consider that in the conventional type the after sections include actual or virtual dead wood, it is evident that the numerical value of a sectional coefficient aft has small significance as indicating the nature of the form with which the water has to deal.

The outstanding result of the experiments was the good showing of stern *F*. Of course, this was partly due to small wetted surface, but stern *F* shows up very well in the curves of residuary resistance, indicating that even with a conventional dead wood added it would still be somewhat the best.

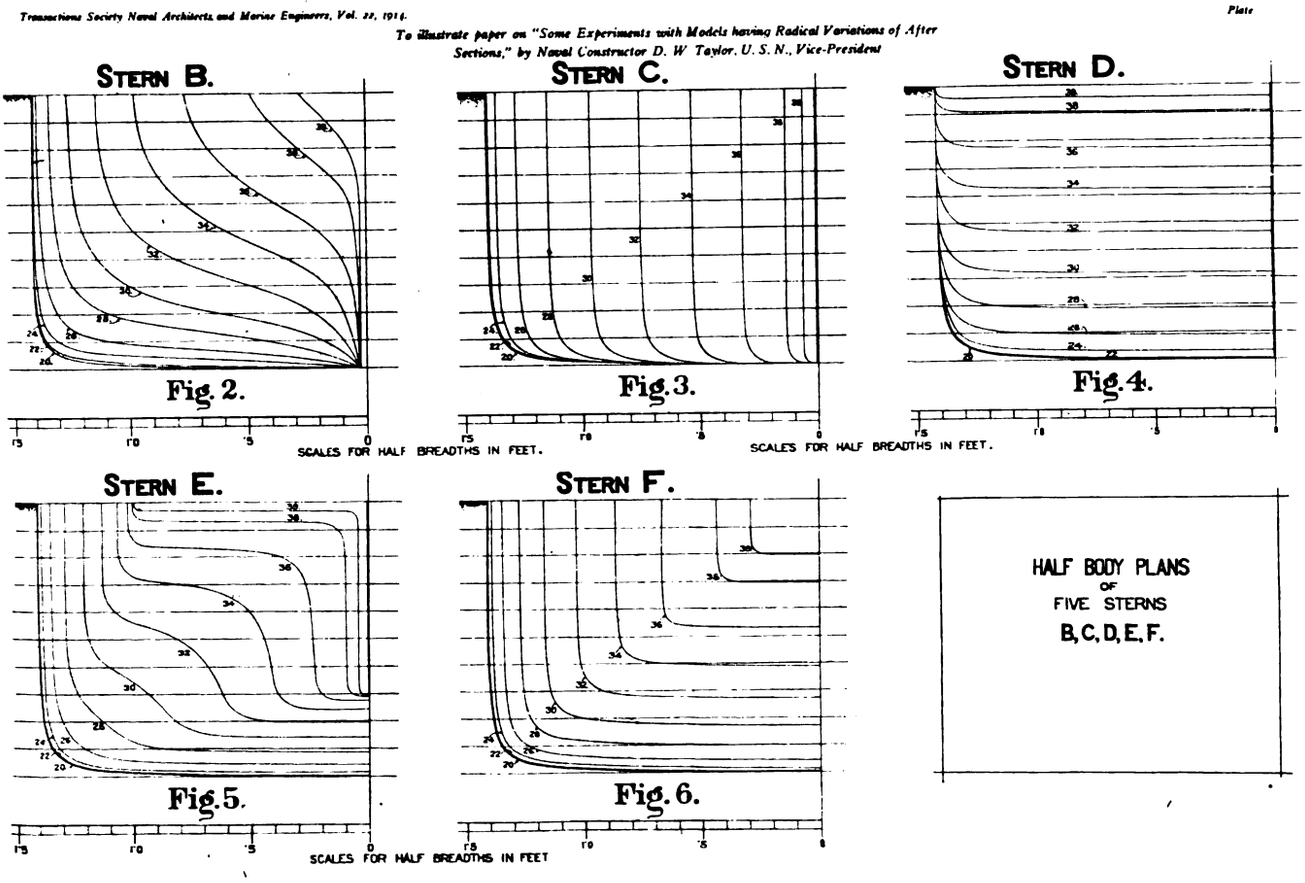
Stern *D*, the exaggerated flat stern, undoubtedly makes the worst showing in Figs. 7 and 8, Plates 3 and 4, which is at first sight surprising in view of the fact that the wide, flat stern is used with success on many fast boats. But the wide, flat stern as used is usually of type somewhere between *D* and *F*, and Figs. 7 and 8, Plates 3 and 4, do not go up to torpedo-boat speed. For 20-foot models torpedo-craft speeds correspond to 8 knots or more, and it is quite possible that at 8 knots stern *D* would show the least resistance. The models used were not of high-speed type, having four or five times as much displacement for a given length as a high-speed torpedo-boat model, and hence were not tested to high speeds. It is interesting to note that the excessive resistance of stern *D* at speeds a little below 5 knots is really due to a characteristic favorable to high speed. The virtual or effective length of model *D* is greater than that of the others and, when the curves of the others are past the 4½-knot hump and drop down into the succeeding hollow curve, *D* is still on the hump.

Other conclusions might be drawn from the curves, but it would not be safe to generalize from a few results. Bearing in mind that a ship of the displacement length coefficient involved would not be powered in practice for speeds above 4 knots, the results appear to indicate that gain could be made at practical speeds by departing from the conventional type of after body, but that they would be comparatively small after all. They would be of the 5 per cent order, not 15 or 20 per cent.

Discussion

HERBERT C. SADLER: In connection with Naval Constructor Taylor's paper, I may say that it confirms in every respect some experiments that I conducted some years ago in connection with barge forms. They were somewhat more simple forms even than those of Mr. Taylor's, with square forms. We found that the form, such as shown in the stern *F*, was, on the whole, the best form for ordinary working conditions, and provided that we got the correct angle of the line through the bilge, that it had very little extra resistance than the best ship shape form.

With regard to the other forms, the stern *C*, which is a straight-sided vessel, we found that that was decidedly bad under ordinary conditions of depth of water, but in shallow


Transactions Society Naval Architects and Marine Engineers, Vol. 22, 1914.
Plate
To illustrate paper on "Some Experiments with Models having Radical Variations of After Sections," by Naval Constructor D. W Taylor, U. S. N., Vice-President
STERN B.
Fig. 2.
STERN C.
Fig. 3.
STERN D.
Fig. 4.
SCALES FOR HALF BREADTHS IN FEET.
SCALES FOR HALF BREADTHS IN FEET.
STERN E.
Fig. 5.
STERN F.
Fig. 6.
HALF BODY PLANS OF FIVE STERNS B, C, D, E, F.
SCALES FOR HALF BREADTHS IN FEET

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water that type of stern and bow, as a matter of fact, seem to show up slightly better than some others. In that connection, it is interesting to note that in very shallow water the flow would only take place in two directions, and consequently a form that is easy in those directions only, length and breadth, will probably give the form of least resistance, but when you come to deeper water, where the water wants to flow in a diagonal direction, then a form such as shown in stern *C* is decidedly bad. The same thing applies in lesser degree to stern *D*, the ordinary scow-shaped stern—the water does not want to follow in exactly fore and aft lines, evidently it wants to come in from the side, from part of the hull, and come up from the bottom from the other part, and consequently the stern *D* will give slightly more resistance than a stern such as *F*, which is a compromise between the two.

With regard to the stern *E*, that is interesting as illustrating the fact that it is quite possible to make a stern too fine, that is particularly towards the extreme ends. Evidently in that case the water does not want to flow up on quite such a fine bilge diagonal, as shown there, and a fuller form of bilge diagonal will give a more natural flow line and consequently less resistance.

I think from an analysis of some of these simple forms we can get perhaps even more valuable information than we can in a series of experiments on the ordinary ship shape form, because they do indicate in a very clear manner the way in which the water seeks to flow around a ship's hull.

THE CHAIRMAN: Is there any further discussion?

PROF. WILLIAM HOVGAARD: The influence upon resistance of expansion or contraction along the principal dimension was studied experimentally by R. E. Froude, by Naval Constructor D. W. Taylor, and by Col. G. Rota. These experiments I have analyzed, and the result was published in the Transactions of the Naval Architects in London in 1908. I found that the residuary resistance for ships of the cruiser type varied as the square of the beam and as the draught to the first power for speed-length ratios not greater than 1.35. I had not then at my disposal any serial experiments on the expansion of the transverse dimensions in ships of full form such as those experimented on by Prof. Sadler.

For changes in length-scale of cruiser models, and for speed-length ratios up to unity, I found that the residuary resistance was constant at corresponding speeds, but for models of the Connecticut type a discrepancy in this law appeared at speed-length ratios exceeding about 0.75.

I arrived at the following empirical expression for the residuary resistance: $R = b \frac{B^2D}{L^2} V$ where b is a coefficient that varies with the cylindrical coefficient of fineness. This may be written

$$R = B^2D^1L^0\frac{V^4}{L}$$

which appears to hold good for vessels of the warship type up to the point where interference between the blow and stern waves begins to be sensibly felt.

I am much interested in the result obtained by Prof. Sadler, according to which the resistance for ships of ordinary mercantile form at corresponding speeds varies as $B^{1.7}D^{1.1}L^{-.8}$ as against $B_2D_1L_0$ for warships. The discrepancy between the results and those of earlier experimenters must be due to the great difference in the type of the model. Possibly the wave interference is felt earlier in Prof. Sadler's model, and may have obscured the true law of variation,

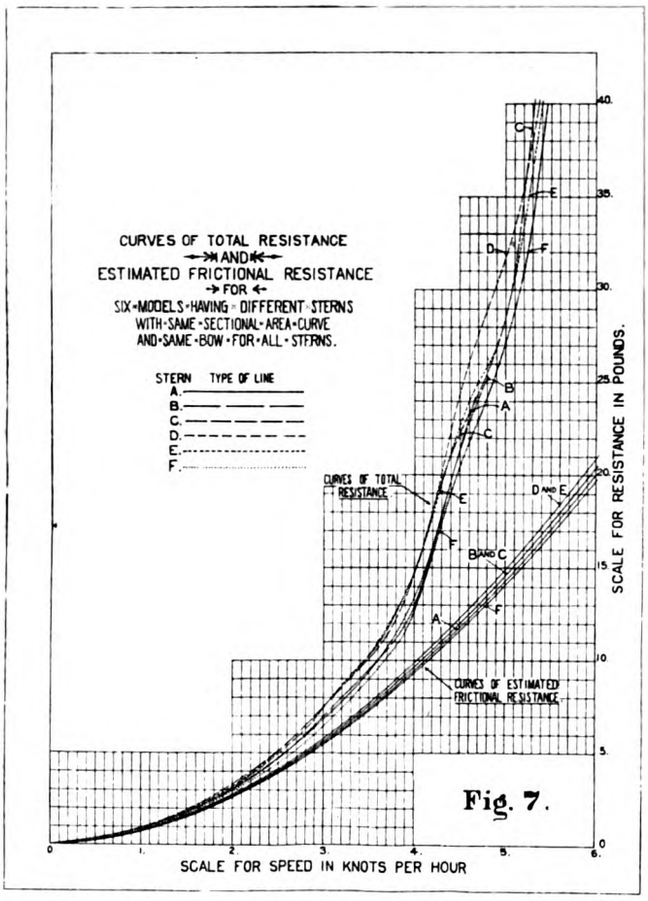

Fig. 7.

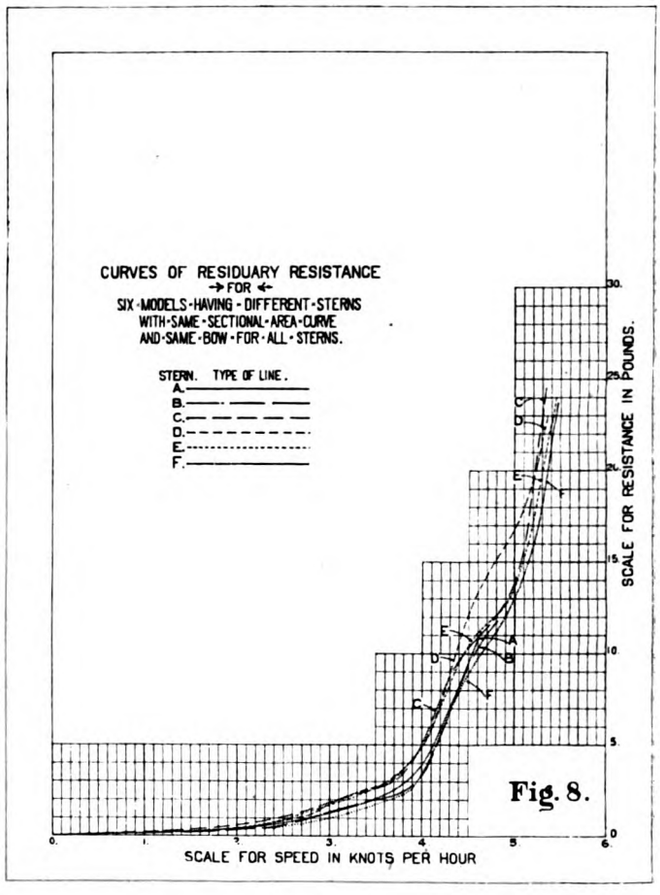

Fig. 8.

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which might still be that obtained for finer vessels. The analysis of the results obtained with the Connecticut model points in that direction. It would be interesting to have Prof. Sadler's opinion on this point.

THE CHAIRMAN: Is there any further discussion? Papers of this character are largely records of observation and most illuminating, but they do not lend themselves so freely to discussion. They require much more careful consideration than the members usually have time to give.

I feel sure, however, that you will be glad to extend your thanks to Prof. Sadler and to Naval Constructor Taylor for preparing and bringing these papers to your attention, and that it is a matter of especial regret to you that Naval Constructor Taylor is not with you in order that he might receive, as he undoubtedly would, your felicitations upon his prospective advancement to the head of one of the most important branches of the public service. His past professional career leaves no doubt whatever that the work he will soon undertake will be carried out with the best possible results for the country and with great credit to himself.

Stability in Collision

Spirited and Interesting Discussion on Mr. Gatewood's Paper on Stability as Affected by Collision at Sea

THE third paper read at Thursday afternoon's session was by William Gatewood on "Stability of Vessel as Affected by Damage Due to Collision." This paper was published in the January MARINE REVIEW. Discussion of it was opened by Naval Constructor Joseph H. Linnard, who said:

My personal impression with regard to this matter from reading the various proceedings and published papers with respect to the action of the committee in London was that these matters had been taken into consideration to the extent that it was deemed feasible. In establishing general rules it is, of course, impossible to figure our detailed cases, which detailed cases are to be dealt with by the respective governments in the way they deem proper to produce the results. I think it has been remarked that as a matter of fact, although there are a great many vessels with very small initial metacentric height, yet it is extremely rare, if not unknown, that merchant ships in cases of damage turn turtle before they go down. I do not have in mind any such case in these disasters that have been recently noted in the press. Perhaps Admiral Capps, having been on the commission, will be able to tell us more in detail as to the considerations that governed the commission in these matters.

JOHN REID: It is many years now since this question of stability came to be considered one of the most important in the design of any ship, but it is certainly curious to find that there are so many ships now sailing, and some even building, in which the stability is so far at fault. If it were not invidious to mention names, I could give you in my experience the names of three or four large Atlantic liners, very popular ships, very comfortable, now on the Atlantic, in which the stability leaves a great deal to be sought; and without mentioning names I am sure that many of you are now aware that there is one large passenger boat now in dock, a vessel which originally cost over half a million dollars, and considerably more, and intended to carry hundreds of passengers, a brand new ship, which is now being cut up and widened by two feet on each side in order to get the stability into shape. That brings up this consideration—how does it come that a ship of that importance, on which so many people are going to be voyaging and risking their lives, can be built by a first-class firm and then have to be radically reconstructed in order to get the stability put right? My impression is that the naval architect is not getting his share in the design that he ought to have. We are all aware that between the ship owner and the shipbuilder there is always a friendly antagonism—sometimes not so friendly—the ship owner wants to get the most out of a given expenditure for a given sized ship, and the shipbuilder wants to get the most satisfactory result, without putting in any more money in the construction of the ship than the price which he contracted to build it. It is remarkable, when you look at the present Atlantic liners of the latest type, to see the enormous height of the superstructure, the reading rooms, the smoke rooms, etc., which have offset, and very more than offset, the advantages gained by great beam as proportionate to the length of the ship. When you are voyaging in one of these very large vessels in every kind of comfort and suddenly, as has happened in my own experience and without any warning, but due to some minor situation, the vessel takes a very heavy lurch and lies right down and stops there for several hours, you begin to realize that in the antagonism between the shipbuilder and the ship owner, the ship owner has probably come out best, so far as the accommodations and super-

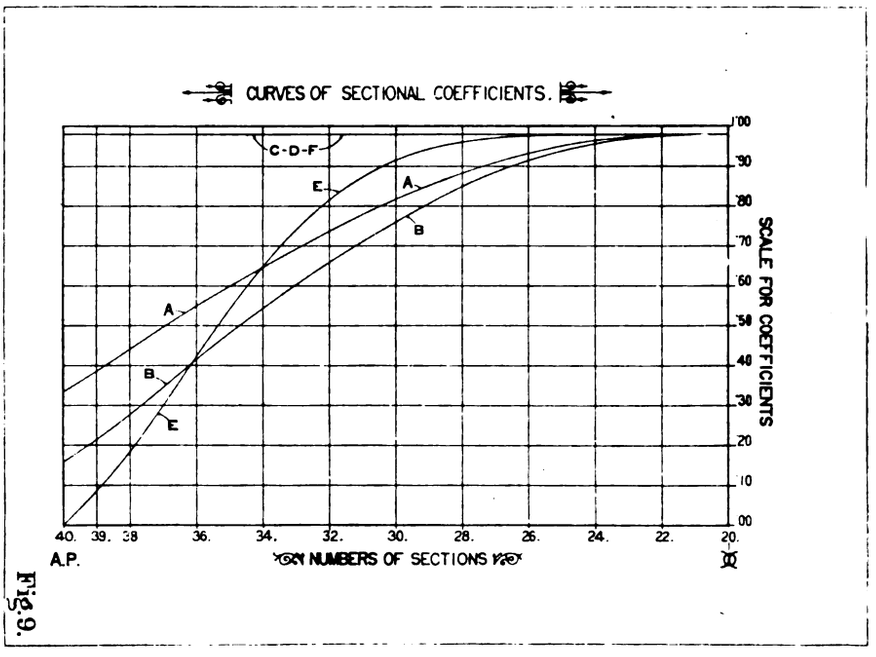

FIG. 9.

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structure is concerned. I do not want to elaborate on that, but I am sure you are all familiar with some of these conditions.

This paper by Mr. Gatewood deals with a proposed ship which he assumes to have been bilged in one compartment, and then he prognosticates what would happen. It is a very remarkable thing, and I think it shows Mr. Gatewood's ability in a remarkable way in this matter, if you put alongside this comparatively small ship the actual facts in the loss of the Empress of Ireland on the St. Lawrence river this year—if you do that you will find that you can run a parallel right through the two cases. I was called upon this summer to investigate that catastrophe in connection with the inquiry at Quebec, and if you will give me a minute or two I will mention a few facts connected with it, partly because there is a good deal of misconception as to what actually occurred on that ship, and partly because it deals with several matters connected with safety of life at sea, to which I think emphasis has not yet, I believe, been given.

Empress of Ireland Case

It is considered by a number of people, as published in the press, that the Empress of Ireland was struck by the collier Storstad a glancing blow, with high speed on the part of the Storstad. Now, what happened and what was demonstrated and proved by the court, was this—That the Storstad struck the Empress of Ireland a blow which did not glance at all, that the speed of the Storstad was comparatively slow, probably not more than four or five knots, and that the Empress of Ireland was also in motion, contributing somewhat to the force of the blow, and that no bulkhead on the Empress of Ireland was destroyed. There is a difference of opinion about that, but I think I am right in saying that it could be easily shown that the Storstad did not destroy any of the bulkheads of the Empress of Ireland. What it did was to cut a hole about eight to ten feet right from the bilge of the Empress of Ireland up to the shelter deck and letting water in on to the lower main deck, and subsequently on to the upper and shelter deck. That hole pierced one of the aft stokeholds. In that stokehold there was a bunker wall. That, of course, trapped the water and from the moment of the impact the Empress began to heel. The stability of the Empress is undisputed—it was more than the average. I understand that the metacentric height was about 42 inches in its loaded condition, at that time. There was no question of the stability or the structure of the vessel. There were no bulkheads destroyed, and therefore as the Empress was designed and built, with two compartments bilged, there should have been no doubt of her ability to stand up under the blow. What happened was that in the divisional bulkhead between the stokeholds there were watertight doors, which were not shut. We have heard of the lack of permeability of spaces filled with coal and other cargo. It was very extraordinary, the rapidity with which the water came in through the break and permeated the bunkers filled more or less with coal. As the water came over the lower deck it went through the bulkhead doors, from one stokehold into the other, down through the deck escape hatches into the lower bunker, and out through the bunker door on the stokehold floor in five seconds. A man in the forward stokehold had water coming out on the platform almost immediately after the impact. To make a long story short, this longitudinal bunker wall prevented the water from going across the ship and the Empress heeled from the moment of impact, and went over in 12 minutes, absolutely capsized.

Mr. Linnard stated that very few ships capsize after being bilged, but the case of the Empress of Ireland was an exceptional matter. There would have been no loss of life had not the Empress heeled over the moment the impact took place and went down in such a way that the boats could not be launched, and undoubtedly the horror of the catastrophe was entirely due to the failure of the stability of the ship under these conditions.

Now, when we are discussing papers of this kind we are all anxious to assist in any little way we can in improving the safety of ships at sea, and you cannot find in the design of the Empress of Ireland any faults in the structural arrangements or in the calculations, but if you have a series of bulkheads pierced by doors, and these doors are not shut, and cannot be shut, no time to shut them, then, of course a catastrophe might result from a very small, comparatively small, damage. The only way to obviate that is to have the very latest system of bulkhead subdivision and bulkhead doors, and means for closing the doors.

I am positive nothing is to be gained by having anything automatic. We have heard in this meeting today about automatic sprinklers. Lots of people have tried to use automatic stokers and automatic covers and all kinds of automatic things on board ship. They are all right in their way on land, but when you put them into ships, in which the conditions vary from minute to minute, hour to hour, and day to day, nothing will enable you to do away with the importance of eternal vigilance, supervision day by day by the engineers and officers, and this is true of all classes of boats, no matter whether it is a motor boat, a catboat, a merchantman, or a belligerent battleship or cruiser in which, whenever anything automatic is installed, you find that when the time comes to use it you cannot use it. This question of stability is one to which we should pay more attention in the future at these meetings than it has had in the past. I hope this is only a beginning in the matter.

THE CHAIRMAN: Do you know how low the water lines were on the doors on the Empress?

JOHN REID: Eight or ten feet below the original water line.

THE CHAIRMAN: Were they at the side, so there was a longitudinal bulkhead there?

Admiral Capps' Comments

JOHN REID: There was a corresponding tank on the other side, and then a bulkhead in the center.

THE CHAIRMAN: A water tight bulkhead in the center?

JOHN REID: A divisional bulkhead.

THE CHAIRMAN: Enough to confine the water to one side?

JOHN REID: Yes, and also there was a steampipe channel in there that kept the water from going across rapidly. The water tended to flow from one stokehold into the other through the open doors.

ADMIRAL CAPPS, Chairman: Is there any further discussion? This paper deals with a tremendously interesting subject, one that is literally fundamental in all questions relating to safety at sea. I was particularly interested, not only in the subject of the paper, but in the comments of Mr. Reid with respect to the very sad catastrophe on the St. Lawrence. His statement taken from the facts deduced by the inquiry, I presume, indicates a state of affairs that personally I had always taken very deep interest in, to the extent of violently opposing any openings in transverse bulkheads so long as you could possibly do without them. There have been numerous catastrophes which have resulted directly from openings in main transverse bulkheads, which, at the critical moment were not closed, although all facilities for closing them were provided, so that wherever possible, one is led to the inevitable conclusion, the safe bulkhead is one without openings.

The whole question of stability, as suggested by Mr. Linard, was taken up at the London conference, but by

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no means was any attempt made to arrive at definite conclusions, else we would have been there yet. It was a matter of such intricate technical expression that it is almost safe to say that no large group of even most highly trained professional men could in any reasonable limit of time evolve a set of rules which would with any degree of safety be made into law. That was one of the very curious features developed in the discussion. The commission, of which I was a member, were very strongly in favor in the beginning of trying to develop some general regulations which would at least control the subject and compel the most serious attention thereto on the part of designers. One of the first obstacles we ran against was the rather strong opposition, not of those who owned ships, but of those who designed and built ships, as to the practicability of developing suitable and satisfactory regulations. Incidentally, in the heat of discussion there developed the fact that certain very large vessels, well known, which had longitudinal subdivisions, and which longitudinal subdivision presumably added very much to the safety of the vessel in the popular mind, at least, also had instructions given to the officers on board that, in the event of accident, these longitudinal bulkheads would be practically out of commission by opening the doors, and the fear of producing the very result which, according to the testimony of Mr. Reid, happened in the case of the Empress of Ireland in the St. Lawrence river. If a large amount of side was opened to the sea, and an intervening bulkhead confined that water to one side of the vessel, it might result in disaster to the vessel.

I mention this matter of stability in connection with the London conference to show that it was not overlooked, but in the very free discussion which ensued on bringing up the question, the practical difficulty of doing anything satisfactory in any reasonable time was so great, that that particular subject had to be left to the skill of individual designers, and I have no doubt that if designers are not unduly limited by owners, the results will be very satisfactory; but if they are limited by owners in such a way as to impair the integrity of the design under certain conditions of damage, then it does seem to me that a naval architect of the right professional feeling will deliberately decline to have his name associated with such design, and I feel quite sure that such a stand by eminent professional men would prevent any one interested in taking any chance in such a serious technical matter.

Annual Report Lighthouse Board

The annual report of the Commissioner of Lighthouses to the Secretary of Commerce for the fiscal year ended June 30, 1914, indicates that the efficiency of the service has been increased by the reorganization of July, 1910, and that the work is more economically performed. Up to July 1, 1914, there has been an increase of 2,485 or more than 21 per cent, in the number of aids maintained over the corresponding number on July 1, 1910, while the total general appropriations for the support of the service for the fiscal year 1915 are about $320,000 less than those for the fiscal year 1911.

The United States Lighthouse Service maintains aids to navigation on all coasts under the jurisdiction of the United States, except the Philippine Islands and Panama, and also on the principal interior rivers. This service is charged with the maintenance of aids to navigation along 46,828 statute miles of coast line and river channel.

On June 30, 1914, there were 5,562 persons employed in the Lighthouse Service, including 93 technical force, 143 clerical force, and 5,326 employees connected with depots, lighthouses and vessels.

During the fiscal year there was a net increase of 677 in the number of aids to navigation maintained, the total at the end of the year being 14,198. Of these 5,004 are lights of all classes and 567 are fog signals. The total number of aids in Alaska, including lights, fog signals, buoys, and daymarks, in commission at the close of the fiscal year was 319, including 108 lights, representing an increase of 71 lights since June 30, 1910, or nearly 200 per cent.

Improvements in aids to navigation have been made as follows: Flashing or occulting lights were installed in place of fixed lights at 67 stations; incandescent oil-vapor lights were substituted for oil-wick lamps at 37 stations; acetylene or oil-gas lights were substituted for oil lights at 73 stations. Attention is invited to the fact that incandescent oil vapor is now used as the illuminant at 268 stations, comprising nearly all the principal seacoast lights in the service.

Careful attention was given at the General Lighthouse Depot, Tompkinsville, to the manufacture and standardization of various articles, and substantial savings were effected in the cases of parts heretofore purchased. At this depot apparatus and supplies are tested, and experimental work is done for the improvement of equipment and apparatus of the service.

Improvements have been made in connection with oil-vapor lamps, electric lamps, post lanterns, lens clocks, fog signal apparatus, etc. A type of torch for starting internal combustion oil engines more quickly is of value in the event of sudden fog. The use of electric lights for harbor lights has been extended where a reliable source of supply is available, and such installations have in general been equipped with automatic devices for substituting another lamp or for calling the keeper, in case of failure.

During the fiscal year 45 tenders and 66 light vessels were in commission. The new tender Laurel was launched and will be completed during the present fiscal year. The construction of new light vessels Nos. 96 and 98 was well advanced, both vessels being launched, and both will be completed during the current fiscal year. A contract was awarded for the small tender Fern, for service in the inside waters of Alaska. Plans are also under way for the construction of four additional light vessels, and two tenders.

Systematic inspections have been continued in the various lighthouse districts, of the technical work, and of business methods, and property accounts.

A standard method of cost keeping has been continued in effect which is useful in preparing estimates, planning work, effecting economies, and comparing relative efficiencies. A number of additional improvements and economies have been introduced in the administration of the service.

Several new works under special appropriations were completed during the fiscal year. Those of principal importance are as follows: Newark Bay Lights, N. J.; Negro Point Light and Fog Signal, N. Y.; Buffalo Breakwater North End Light & Fog Signal Station, N. Y.; protection by riprap at Sand Island Light Station, Alabama; improvements at San Juan Depot, P. R.; storehouse for oil, Woods Hole Lighthouse Depot, Mass.; a new system of lights for St. Marys River, Mich., isolated oil houses at 38 light stations, and a dwelling for the keeper at Kauhola Point Light Station, Hawaii, were also completed. Much other important construction work was in progress at the end of the fiscal year.

During the fiscal year 1914, services in saving of life and property were rendered and acts of heroism performed by employees of the lighthouse service on vessels or at stations on 124 occasions.

Recommendation is renewed for legislation authorizing the retirement of employees of the lighthouse service on account of age or disability incident to their work, which is the practice in the lighthouse services of most other countries.

The appropriations for the maintenance of the lighthouse service for the fiscal year 1915 are $5,151,630.

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Annual Report Steamboat Inspection Service

The annual report of the supervising inspector general of the steamboat inspection service, department of commerce, covering the operations of the service for the fiscal year ended June 30, 1914, contains a complete summary of the work accomplished in the fiscal year and a number of recommendations looking to the improvement of the service by which the safety of life and property in travel by water may be more definitely and positively assured.

The steamboat inspection service, as its name implies, exists for the purpose of inspecting vessels of the American merchant marine which are required by law to be inspected, the licensing of officers, the conducting of investigations of casualties and violations of the law, the regulation of the transportation of persons and articles, and the making of certain inspections for other departments of the government.

The work of the service is conducted by the supervising inspector general who is stationed in Washington, D. C., and in the service at large by an inspection force of 187 and 70 clerks to boards of local inspectors. The total expenditures in the fiscal year amounted to $529,762.69.

Certificates of inspection were issued to 7,385 domestic steam, sail, and motor vessels and barges having a gross tonnage of 5,596,504 and to 545 foreign passenger steam vessels with a gross tonnage of 4,374,006, making a total of 7,930 vessels with a gross tonnage of 9,970,510.

Licenses were issued to 9,028 officers of steam vessels, 9,706 officers of motor-vessels and 137 officers of sail vessels and barges, making a total of 18,871 officers licensed.

Miscellaneous inspections included 60 steam vessels granted letters of approval of designs of boilers, engines, and other operating machinery, 92 hulls of United States government vessels, and 1,326 boilers in or for United States government steamers and buildings. There were 3,045 reinspections of passenger and ferry steamers made, 3,159 boiler plates were tested at the mills, and 175,332 new life preservers were inspected.

During the past fiscal year, on vessels subject to inspection, there were 232 accidents resulting in the loss of 582 lives, of whom 105 were passengers and 477 members of crews. There were 318,094,347 passengers carried on steam vessels that are required by law to report the number of passengers carried. Dividing this number by 105, the total number of passengers lost, shows that 3,029,469 passengers were carried for each passenger lost.

Under the rules of the board of supervising inspectors blue prints descriptive of the hull construction of certain vessels are required to be filed with the local inspectors having jurisdiction, but it is not at present required that these blue prints be approved by the local inspectors with whom they are filed. The supervising inspector general recommends that there be stationed in his office a corp of experts whose business it would be to approve the proposed hull construction. This would enable the department to employ experts who are more familiar with hull construction than the local inspectors, and it would result in that uniform administration of the law with which the supervising inspector general is charged. To adopt such a system would require the enactment of a statute giving this express authority to the steamboat inspection service, and it would require a larger appropriation for the employment of experts for the purpose named.

The steamboat inspection service inspects vessels in order to make travel by water safer, and the most important thing to do is to make the ship itself as nearly unsinkable as possible. Having done this, it then becomes necessary to place on board the vessel the proper equipment to take care of those who travel on the ship, and to see that the vessel is properly manned. It is believed that the greatest peril which has to be met on board ship is fire, and the supervising inspector general recommends that such legislation be enacted as will require fireproof construction, such as has been tested with eminent success, on all excursion steamers hereafter built or contracted for.

The belief is expressed that the most effective way to secure uniformity in boiler construction is to require that all boilers used on vessels subject to inspection shall first be approved by a corps of experts in the office of the supervising inspector general. While the inspectors in the field service have done excellent work in this respect, it nevertheless remains a fact that this service itself must keep abreast of the most progressive business organizations; and, therefore, the bureau recommends that the law be changed so as to require the approval of the design of these boilers in the office of the supervising inspector general.

With reference to boiler inspection, amendment of the present law is recommended by the supervising inspector general so that the working pressure allowed steam boilers may be determined by the rules of the board of supervising inspectors. The result of such amendment would give the board of supervising inspectors that discretionary authority for arranging for boiler construction that the board should possess in order to make its rules meet the best modern practice.

A further amendment of the law is also recommended so that the matter of the number of persons that shall be carried on vessels may be more easily controlled.

Strong efforts have been made to control as much as possible the matter of the transportation of dangerous articles on steamers carrying passengers, but authority should be extended, in the opinion of the supervising inspector general to give the service control and jurisdiction over the transportation of dangerous articles on steamers that do not carry passengers. While from the commercial standpoint it may be said that there are no passengers on these freight vessels, it is nevertheless a fact that the government owes a duty of protection to the crews on these vessels. It is also none the less a fact that by the carrying of dangerous articles in a dangerous manner on steamers that are not carrying passengers, the lives of those on passenger-carrying steamers may be jeopardized.

A Big Lumber Crane

The Seattle, Wash., Port Commission has recently awarded to the Shaw Electric Crane Co., of Muskegon, Mich., a contract for a lumber-handling wharf crane which will be larger than any crane previously installed for this class of service. This crane is the double cantilever type with an overall length of a little over 200 feet, and the range of travel along the pier is approximately 800 feet. The end of the crane bridge projecting over the water is hinged to swing upward for purpose of clearance.

Lumber will be handled by a special grapple and in units containing 1,500 feet, board measure. A standard hook may be substituted for the grapple, for handling structural steel and miscellaneous cargo. The openings through the gantry legs are wide enough to permit carrying material 32 feet long without interference. Means will be provided for transporting 9,000 feet of lumber on one of the gantry legs, in addition to the load carried by the grapple.

This installation is interesting because it is a forwerd step in the handling of lumber by the unit system and because it is the first municipal pier to be equipped with cargo cranes, indicating the progressive spirit of the Pacific coast cities.

Swan, Hunter & Wigham Richardson, Wallsend-on-Tyne, launched 18 vessels of 86,627 gross tons and 56,930 indicated horsepower during 1914. During the past eleven years this company has launched 229 vessels of 1,014,506 gross tons.

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Lake Carriers' Night Schools

Classes Are Being Conducted in Five Cities for the Benefit of the Men Aboard Ship—Tangible Results

THE night schools which were so successfully operated in the assembly rooms of the Lake Carriers' Association in the cities of Buffalo, Cleveland, Detroit, Marine City and Duluth last year for the benefit of the men aboard ship, opened in the same cities on Jan. 4 and will continue on three evenings a week until Mar. 26, at which time the men usually go to the boats to begin the work of fitting out for the season of navigation. It is probable also that a school will be opened in the assembly rooms at Milwaukee, if a competent instructor can be secured in the near future.

The schools will be conducted on Monday, Wednesday and Friday evenings in all of the cities, with the exception of Detroit, where the evenings will be Monday, Wednesday and Thursday.

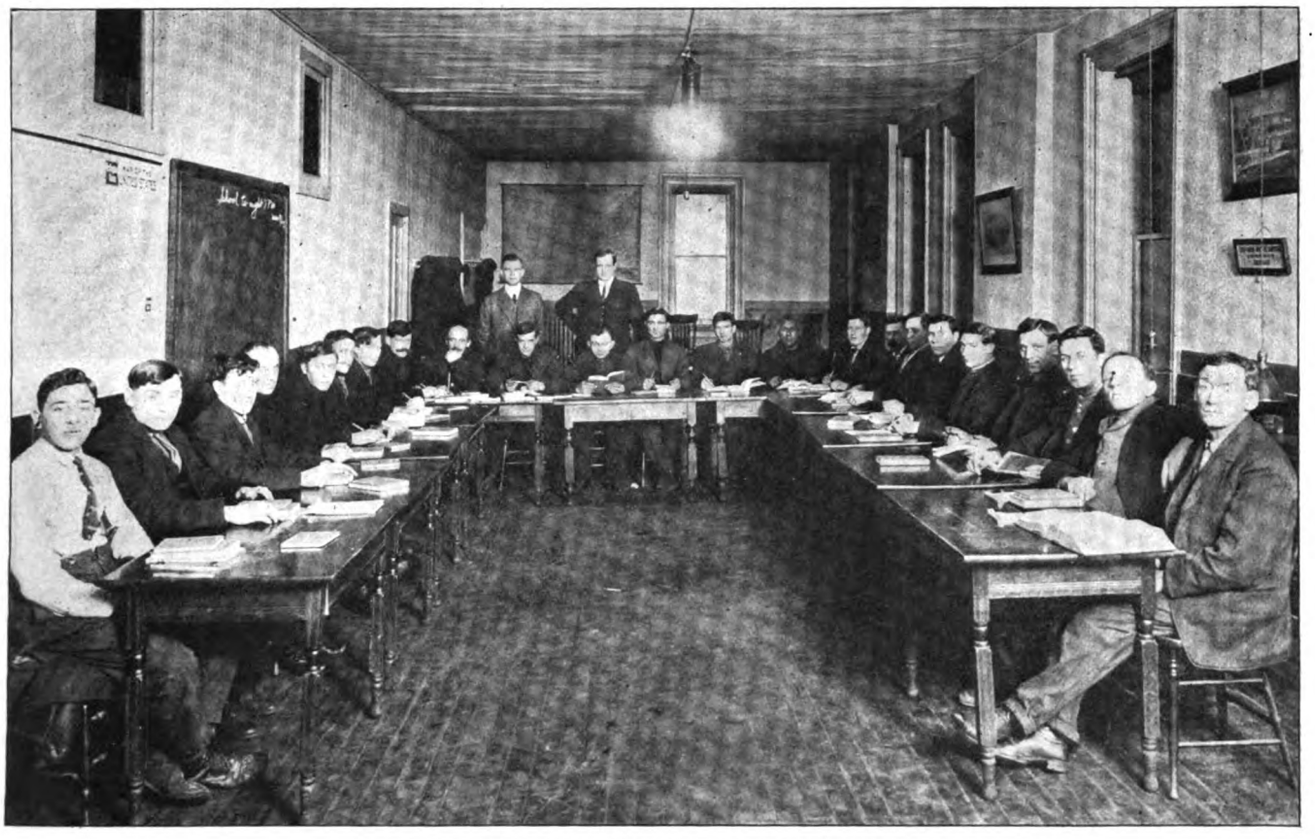
Harry Stone, chief engineer of the steamer Joshua W. Rhodes, has charge of the classes at Marine City, H. R. Smallenburg at Buffalo, Geo. A. Green at Cleveland, Warren J. Frye at Detroit, and Miss Anna B. Meinhardt at Duluth.

The Educational Committee of the Lake Carriers' Association made a tour of the lakes and made all the necessary arrangements for the schools. The main purpose of establishing these schools is to help many young men who are struggling against the lack of early advantages, and who, if they can be helped over this barrier, will be in line for general advancement aboard ship. Arithmetic, spelling, grammar, history and geography will be taught, and lectures in personal hygiene will occasionally be given by practicing physicians.

It was the experience of the teachers last year that the requirement of the pupils covered a very wide range, some of them being unable to read or write, whole others were sufficiently advanced to take up algebra and higher mathematics. This situation, of course, involved quite a problem for a single teacher, but it was fairly successfully met.

The object is to encourage ambitious young men who may eventually desire to present themselves before the Steamboat Inspectors for examination for licenses. Last year out of a class of 38 students at Marine City, 15 were successful in obtaining licenses from the inspectors, about equally divided between the forward and after ends of the ship. The marked success in this particular instance however was due to the natural qualifications of Harry Stone as a teacher.

The thought in mind in this work is to develop young men who are eager to advance to responsible positions aboard ship. The schools which were started in the winter of 1913-1914 proved that there were quite a number of young men who lacked the rudiments of education and who needed only assistance along these lines to help themselves thereafter. Reports indicate that the attendance this year is large and that the men are taking great interest in the work. The classes are being conducted upon practical lines and will undoubtedly have the effect of widening the field from which future licensed officers will be drawn. This work is under the special jurisdiction of the educational committee.



THE SCHOOL IN THE ASSEMBLY ROOMS AT CLEVELAND

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THE SCHOOL IN THE ASSEMBLY ROOMS AT BUFFALO

THE SCHOOL AT MARINE CITY, HARRY STONE, TEACHER, IN RIGHT FOREGROUND

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THE DETROIT SCHOOL

THE ASSEMBLY ROOMS AT SOUTH CHICAGO

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THE MARINE REVIEW

DEVOTED TO MARINE ENGINEERING, SHIP BUILDING AND ALLIED INDUSTRIES

Published Monthly by

The Penton Publishing Company

Penton Building, Cleveland.

CHICAGO	1521-23 Lytton Bldg.
CINCINNATI	503 Mercantile Library Bldg.
NEW YORK	507 West Street Bldg.
PITTSBURGH	2148-49 Oliver Bldg.
WASHINGTON, D. C.	206 Corcoran Bldg.
BIRMINGHAM, ENG.	Prince's Chambers

Subscription, $2 delivered free anywhere in the world.
Single copies, 20 cents. Back numbers over three months, 50 cents.

Change of advertising copy must reach this office on or before the first of each month.

The Cleveland News Co. will supply the trade with THE MARINE REVIEW through the regular channels of the American News Co.

European Agents, The International News Co., Breams Building, Chancery Lane, London, E. C., England.

Entered at the Post Office at Cleveland, Ohio, as Second Class Matter.

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February, 1915

"Some Collier"

Calling public attention to the criminal waste of public funds by the naval establishment will probably be productive of just as much good as the efforts of patriotic individuals, commercial bodies, ship owners and others have been in the upbuilding of a merchant marine. The same people who shouted "shipping trust", "capitalistic greed" and all the other well known and time tried outgivings of politicians and agitators who didn't even know what they were talking about, and found when the country was confronted with the very situation which year after year they had been warned against, that even less than the truth had been told them, were not only eager to vote for government purchase and operation of steamships ten times all that had ever been asked, not for purchase or operation, but merely assistance in the production of a great national shipping. They are willing dupes of an establishment which wastes more every year than the country was ever asked to set apart for the aid of a merchant marine in twenty.

Perhaps to them the following data regarding one single unit of that great and spectacular establishment may not even be intelligible, not to say interesting.

The fleet collier Jupiter was authorized by the naval appropriation act of May 13, 1908, to cost not over $1,800,000. The scandal of the earlier naval built colliers and the attention drawn to them first by MARINE REVIEW and later by other publications, led to this cost being reduced, by the act of March 3, 1909, to $900,000. Although this figure was ample for the purpose the navy were not satisfied, so they came back with a revised estimate, for the same ship, of $1,000,000, which was granted by the naval act of June 24, 1910. A mere trifle, observe, of $800,000 below their first estimate. However, as the getting seemed to be good, they came back again in the Naval Act of March 4, 1911, and got this increased to $1,200,000. And was construction proceeding during this time? By no means. What do you think the naval establishment is, a base commercial affair? Not a thing doing until the last grab, although for years the navy just couldn't wait another minute for that collier.

So on Oct. 18, 1911, seven months after the $1,200,000 was safely put where no one could get it except the right parties, the keel was laid, and in April, 1913, eighteen months later, this gem of naval construction went into commission.

Now it so happened that the same act of March 4, 1911, authorized two other colliers of the same type, the contract for which went to the Maryland Steel Co., Sparrows Point, Md., at $951,000 each. The contract was signed on Aug. 22, 1911, and thirty-six days later the keel was laid, she was launched five months and seventeen days later and was delivered and accepted in eleven months from the laying of the keel, 13 months ahead of contract time.

All three ships were built to the same standard of inspection and classification, the only substantial difference being that the Jupiter was fitted with electric drive propelling machinery.

Lieutenant S. M. Robinson, U. S. N., is authority for the statement that the Jupiter's actual cost was $1,271,986. Of course, as has been repeatedly pointed out, these figures are not worth the trouble of quoting for comparative purposes. The Jupiter's costs carry no charges for interest, maintenance, depreciation or insurance of plant or materials, no taxes, heating, lighting, salaries or other overhead charges such as are of necessity included in the contractor's bid, to say nothing at all of profit, with which of course the public is not concerned. The other charges, however, are unescapable and are shouldered by the public whether they believe it or not. The Jupiter, if her costs were kept on the same basis as the Jason's and Orion's, would be found to be not far from double theirs.

And now see what the public gets for this. In a paper presented at the recent meeting of the American Society of Naval Architects and Marine Engineers, Lieut. Robinson says:

"The Jupiter has been in commission over a year and a half. During that time she has conducted two official trials and has carried on the usual routine work of a navy collier. She has steamed about 14,000 miles."

In other words this gilded collier has averaged about 30 miles per day or a little over two hours steaming at contract speed. She carries 159 men all told, of whom no less than fifty-five are in the engineers' division exclusive of engineer officers. Rather

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strong-handed for a ship of moderate power, about 5,500.

Figures are not at hand as to the amount of payroll but certainly we will err on the safe side in assuming an average for all grades of $2.00 per day, or say $300 per day all told, or $164,000.00 for the year and a half she has been in commission. An interest rate of five per cent is surely not too high in these days nor a depreciation of ten per cent considering the haste with which naval vessels become "obsolete." Although no naval ship ever reached so low a maintenance cost as five per cent per year, we will assume such a rate as on the same basis is common in merchant work.

We have right to assume further that the ship has steamed her 14,000 miles at contract speed; probably incorrect but entirely within the possibilities because it was for such service she was designed. We will, however, concede that she averaged 10 knots. Her trial data show a coal consumption of 5,050 pounds per hour at this speed, or 3,535 tons for the distance. If the time required to make 14,000 miles at 10 per hour is deducted from the total there are left 488 days of lay time during which the fuel consumption would fall off to perhaps 10 tons per day, or a total fuel consumption of 8,400 tons. Bunker coal costs at Hampton Roads about $3.00 per ton on board—the navy has paid more under contract.

Subsistence costs are not available but are probably not less than the average of a number of American merchant fleets of good class where the cost is about 50 cents per man per day.

Engineers' and boatswains' supplies, oils, waste, manila, wire, paint, etc., are probably not less than $25.00 per day.

Since the collier can only take cargo one way it is proper to consider that she transported full cargo 7,000 miles. Let us see, therefore, what an impressionable and misguided public paid for handling this 14,600 tons 7,000 miles.

Interest 5 per cent on $1,272,000 1½ years	$ 95,400.00
Depreciation 10 per cent on $1,272,000, 1½ years	190,800.00
Maintenance 5 per cent on $1,272,000 1½ years	95,400.00
Pay roll, 545 days, at $300.00 1½ years	164,000.00
Subsistence, 159 men, 545 days, at 50c	43,327.00
Fuel, 8,400 tons, at $3.00	25,200.00
Supplies, 545 days, at $25.00	13,625.00
	$627,752.00

This is almost exactly $43.00 per ton, or adding the purchase price of the coal, $46.00 per ton. During the famous "world cruise" of which so much was made, the department secured chartered collier service for even greater distance at as low as $7.00 per ton. If the cost were worked out as above on the basis of actual cost, the figure, it is easily seen, would be vastly higher.

The United States government, through its various commissions, attorney generals, secretaries of commerce and other institutions chiefly remarkable for their complete lack of knowledge or experience qualifying them to speak expertly, has been extremely busy advising the general business of the country as to how it should conduct its affairs, but the worst case of mismanagement and business depravity ever pointed out, or even hinted at, becomes an example of 100 per cent efficiency compared with the scandalous inefficiency and waste of one of the nation's own principal departments.

However, as we said at the beginning, calling attention, as the REVIEW has done for years, to the facts is probably so much more time wasted.

The Hardy Bill

The Hardy bill, which passed the house of representatives on July 6, last, is now before the senate for consideration. This bill bears the misleading title "To Better Regulate the Serving of Licensed Officers in the Merchant Service of the United States and to Promote Safety at Sea".

The bill amends Sections 4448 and 4449 of the revised statutes. Considerable dust is raised over 4448, but the amendments to this section are unimportant and are probably intended to obscure the highly important amendment which is made to 4449. This section has stood on the statute books since 1866 and has been a very business-like and workable measure. There is absolutely no reason in the world for changing it.

The section as amended reads:

"That if any licensed officer shall, to the hindrance of commerce, wrongfully or unreasonably refuse to perform his official duties after having signed articles, or while employed on any vessel as authorized by the terms of the certificate of license, or if any pilot or engineer shall refuse to admit into the pilot house or engine room any person whom the master or owner of the vessel may desire to place there for the purpose of learning the profession, his license shall be revoked or suspended upon the same proceedings as are provided in other cases of revocation or suspension of such license."

It will be noted that the section has been amended by the very adroit insertion of the words "after having signed articles". In other words, until the licensed officer has actually signed articles he is absolutely beyond reach of the steamboat inspection service. As long as he has not actually shipped upon a steamer the government inspectors are powerless to exercise any jurisdiction over him. This amendment is a most unwarranted attempt to thwart the functions of government. No steamer can leave port without its full quota of licensed officers and no person can take a vessel out of port unless he has a license from the government to do so. If this amendment should pass, it would be quite within the power of a very few licensed officers to combine to tie up any ship whatever.

The index to THE MARINE REVIEW for the year 1914 is now ready and will be mailed to all subscribers who request it.

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Grain Bill of Lading Settled

The vexed question of grain shortage which has annoyed vessel owners for years has finally reached a settlement in a manner that is quite satisfactory to vessel owners and can probably be worked out also to the satisfaction of the grain shippers. The vessel hitherto has always been held liable for any shortage in the cargo and certainly during the past season there were many grievous shortages. In fact, some vessel owners had the most uncomfortable experience of carrying grain at ruinous rates and then going down into their own pockets besides for a substantial sum of money to cover shortage. These trips of course resulted in a direct loss to the vessel owner. Shortages were so frequent during the year as to become especially irksome. Vessel owners felt that something would have to be done and for the first time in their lives they presented a united front on the proposition. The Lake Carriers' Association, the Association of Lake Lines and the Dominion Marine Association made common cause of it. Meetings were held in Cleveland, Buffalo and Detroit on the subject during the fall but it was not until the Detroit meeting, on Jan. 6, that a definite plan was outlined. Statistics proved that when shortages and overages were balanced the net shortage worked out somewhat less than a peck per 1,000 bushels carried. It was therefore decided that all grain charters accepted for vessels in the Lake Carriers' Association, the Association of Lake Lines and the Dominion Marine Association must contain a clause limiting the shortage to one-quarter bushel in 1,000 bushels. No grain will hereafter be handled by vessels enrolled in these associations on any other basis. The arrangement has the merit of absolute fairness as the grain shippers are not being deprived of anything that belongs to them. No claims whatever will be made for overruns by vessel owners. Freight will be collected on the actual outturn and the vessel owner will then allow ¼ bushel shortage per 1,000 bushels carried and pay the shipper the market price for it out of freight money. The following clause has therefore been adopted to be used in place of the one hitherto in force:

"The vessel shall make no claim for any overrun in the outturn of cargo and assumes no responsibility for shortage but shall allow a fixed amount of ¼ bushel per 1,000 bushels as tare to be deducted from the freight. All grain on board is to be delivered and freight is to be collected upon actual outturn. Where two or more shipments are carried in the same compartment of the vessel, the shortage, if any, resulting upon unloading the last of these shall be borne pro rata by the shippers."

The grain shippers are now working on a plan to operate under the new bill of lading which will probably result in some form of insurance. As far as the vessel owners are concerned they regard the matter as definitely settled and it shows what can be done by organized effort. They have chafed under the old bill of lading for years while the remedy lay at all times in their own hands.

Ore on Dock Dec. 1

Figures compiled by THE MARINE REVIEW from the returns sent in by the various dock companies show that ore receipts at Lake Erie ports during the season of 1914 were 25,402,655 tons, out of a total movement by lake of 32,021,897 tons. Lake Erie docks on Dec. 1 held a balance of 8,407,905 tons, this being the smallest balance for the past five years with the exception of 1913, when 9,261,676 tons remained on dock. During 1913 the total shipment by lake was 49,070,478 tons, of which Lake Erie docks received 39,099,647 tons and held a balance on Dec. 1, 1913, of 9,261,676 tons.

During 1912 the total shipment by lake was 47,435,777 tons, of which Lake Erie docks received 37,472,108 tons, and held a balance on Dec. 1, 1912, of 10,080,798 tons. During 1911, the total shipment by lake was 32,130,411, of which Lake Erie docks received 25,531,550 tons and held a balance on Dec. 1, 1911, of 9,469,869 tons. During 1910, the total shipment by lake was 42,620,201 tons, of which Lake Erie docks received 34,042,897 tons and held a balance on Dec. 1, 1910, of 9,797,980 tons. During 1909, the total shipment by lake was 41,683,873 tons, of which Lake Erie docks received 33,672,825 tons and held a balance on Dec. 1, 1909, of 9,471,428 tons. The reserve of 8,407,905 tons is more than will be needed for winter consumption. Never in the history of the trade have 5,000,000 tons gone forward from dock to furnace during the winter season.

Shipments to furnaces between May 1 and Dec. 1, 1914, aggregate 22,914,887 tons, compared with 35,747,800 tons in 1913, 33,421,251 tons in 1912, 23,011,274 tons in 1911, 29,724,938 tons in 1910, 30,030,559 tons in 1909, and 17,254,782 tons in 1908.

The shipment to furnaces during the season of navigation, as referred to, are determined in this way: First, we have the amount of ore on Lake Erie docks as of May 1 last, 5,920,137 tons; add to this the receipts of the season just closed, 25,402,655 tons, the total is 31,322,812 tons; deduct the amount on dock Dec. 1, which is 8,407,905 tons, and we have 22,914,887 tons as the amount that was forwarded either direct or from dock to furnace yards.

It is understood, of course, that the difference between the total output of 32,021,897 tons shipped from the Lake Superior mines during 1914 and the receipts of 25,402,655 tons at Lake Erie ports is ore that went to places other than Lake Erie ports, such as furnaces at Lake Michigan ports.

The accompanying tables show receipts at Lake Erie ports and amounts on dock during the past three years.

IRON ORE RECEIPTS AT LAKE ERIE PORTS, GROSS TONS.

	1914.	1913.	1912.	1911.	1910.	1909.
Toledo	773,711	1,084,216	1,411,278	493,345	1,225,202	1,374,224
Sandusky	.....	.....	.....	.....	.....	11,088
Huron	617,363	687,485	540,586	223,947	197,951	243,082
Lorain	1,677,988	3,709,213	3,771,350	2,937,605	2,884,738	2,796,856
Cleveland	5,519,698	8,812,583	7,914,836	4,584,211	6,344,943	6,051,342
Fairport	1,558,134	2,037,126	1,810,381	666,365	1,516,434	1,734,277
Ashtabula	5,318,788	8,336,126	8,158,080	6,359,131	9,620,638	8,056,941
Conneaut	6,263,480	7,849,303	7,839,831	6,931,278	6,309,548	7,007,834
Erie	260,991	713,904	547,067	289,400	942,592	1,235,057
Buffalo	2,913,273	5,506,691	5,060,642	2,802,976	4,704,439	5,002,235
Detroit	332,564	363,001	418,057	243,292	296,412	159,889
Port Colborne	166,665	.....	.....	.....	.....	.....
Total	25,402,655	39,099,647	37,472,108	25,531,550	34,042,897	33,672,825

IRON ORE ON LAKE ERIE DOCKS, DEC. 1, GROSS TONS.

	1914.	1913.	1912.	1911.	1910.	1909.
Toledo	580,600	349,047	549,473	661,382	433,215	332,456
Sandusky	2,471	2,472	2,472	2,471	17,728	39,557
Huron	483,769	441,541	385,810	344,371	375,118	477,333
Lorain	548,097	694,704	904,343	652,526	630,547	912,768
Cleveland	1,757,543	1,930,720	1,888,560	1,589,491	1,638,795	1,547,142
Fairport	406,124	478,014	565,920	636,566	839,970	867,640
Ashtabula	2,749,315	3,202,807	3,350,553	3,295,862	3,287,816	2,594,359
Conneaut	1,160,639	1,248,032	1,429,533	1,237,573	1,329,997	1,411,002
Erie	484,467	594,613	661,330	636,274	792,011	788,046
Buffalo	234,880	319,726	340,261	413,353	452,783	501,125
Total	8,407,905	9,261,676	10,080,798	9,469,869	9,797,980	9,471,428

The New York and Porto Rico Steamship Co., New York, has given contract to the Newport News Ship Building & Dry Dock Co. for a steamer to be a duplicate of the Lorenzo, 347 by 46 by 25 feet and of 7,030 tons displacement.

Richard M. Watt, naval constructor, has been ordered to the Norfolk navy yard as industrial manager.

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Average Stay in Port

There is published herewith a comparative table giving the average stays in upper and lower lake ports of the vessels of the Pittsburgh Steamship Co. for the years 1906, 1910, 1911, 1912, 1913 and 1914. An analysis of the table shows the remarkable progress that has been made in efficiency. Since 1906 the average stay at the unloading ports has been more than cut in half, while even greater efficiency has been attained at the loading ports. For instance, the average stay in lower lake ports in 1906 was 36 hours and 15 minutes, while the average stay at these ports in 1914 was 17 hours and 18 minutes. The average stay at upper lake ports in 1906 was 22 hours and 25 minutes, while the average stay at these ports in 1914 was 9 hours and 12 minutes. The average stay in port receiving and discharging cargoes was 58 hours and 38 minutes in 1906 as compared with 26 hours and 30 minutes in 1914, the time being more than cut in half. The average cargo carried during 1906 was 5,954 gross tons, while the average cargo carried in 1914 was 7,572 tons, making the record of dispatch all the more remarkable. The nearest approach to the present record was made in 1911 when operating conditions were more or less similar to what they were in 1914, the volume of ore traffic during the two years being practically the same. The records are as follows:

	Year 1906. hrs. min.	Year 1910. hrs. min.	Year 1911. hrs. min.	Year 1912. hrs. min.	Year 1913. hrs. min.	Year 1914. hrs. min.
Average stay in lower lake ports	36 15	22 22	17 29	20 9	21 9	17 18
Average stay in upper lake ports	22 25	12 22	10 50	11 51	13 52	9 12
Average time spent in port receiving and discharging cargoes	58 38	34 44	28 19	32 ..	35 11	26 30
	Gross tons.	Gross tons.	Gross tons.	Gross tons.	Gross tons.	Gross tons.
Average cargo carried	5,954	6,634	6,306	6,796	7,283	7,572
Largest cargo carried	13,333	13,296	11,159	13,007	12,373	12,222
Fastest loading record	9,277 in 70 min.	9,788 in 45 min.	9,362 in 25 min.	10,325 in. 2 hr. 35 min.	5,897 in 75 min.	10,613 in 1 hr. 30 min.
Rate of fastest loading record, per hour	7,288	13,051	22,469	4,136	4,718	7,075

Average Ore Cargo for 1914

The average ore cargo carried on the lakes in 1914 was 8,424 gross tons. This is the largest cargo of any season, being 09 tons higher than the average for 1908, which had held the record hitherto. It will be recalled that 1908 was a lean year on the lakes so that only the larger class of vessels were in operation. The same condition existed in degree during 1914, to which is to be added the fact that the ore trade is naturally gravitating to the larger ship. It was predicted in last year's annual report that the record might be overtaken in 1914, as in fact it has. The average cargo of 1914 is 317 tons greater than that of 1913, 684 tons over that of 1912, 1,246 tons over that of 1911 and 1,269 tons over that of 1910. Following are the average cargoes for the past 20 years:

Year	Gross Tons	Year	Gross Tons
1895....	1,800	1905....	6,101
1896....	2,202	1906....	6,973
1897....	3,556	1907....	7,516
1898....	3,517	1908....	8,325
1899....	3,803	1909....	7,777
1900....	3,783	1910....	7,155
1901....	4,459	1911....	7,178
1902....	4,899	1912....	7,740
1903....	5,668	1913....	8,107
1904....	5,272	1914....	8,424

Cargo Records

No cargo records were broken during 1914, but some very respectable loads were carried nevertheless. The largest grain cargo carried during the year was 455,000 bushels of wheat from Fort William to Port McNicoll on Nov. 24 by the steamer W. Grant Morden. The grain carrying record, however, is still held by the steamer William P. Snyder Jr., which carried 464,000 bushels of wheat from Duluth on July 10, 1913. The Morden carried a cargo of 12,474 gross tons of ore from Escanaba to Point Edward, which is the largest cargo of the year, but the record for a single cargo is still held by the steamer H. H. Rogers, which carried 13,333 gross tons from Escanaba to South Chicago. The Morden also carried a cargo of 13,506 net tons of coal from Ashtabula to Fort William, but the coal-carrying record is held by the steamer William P. Snyder, which carried 13,849 net tons of coal from Lorain on Aug. 2, 1913. Neither the William P. Snyder nor the J. M. Schoonmaker carried any grain in 1914, but their largest coal and ore cargoes were as follows:

Wm. P. Snyder: Coal, 13,321 net tons, Lorain to Escanaba. Ore, 12,080 gross tons, Duluth to Ashtabula.

J. M. Schoonmaker: Coal, 13,203 net tons, Ashtabula to Duluth. Ore, 11,887 gross tons, Duluth to Cleveland.

Work of Detroit Marine Post Office

The Marine post office at Detroit served 16,325 vessels during the season of 1914, serving 8,857 in the day time and 7,468 in the night time. The total number of pieces of mail handled was 640,255, of which 429,765 were delivered to passing boats and 210,490 pieces received from them. In addition the post office delivered 414 telegrams and received 590, a total of 1,004. Special delivery letters numbered 704, of which 380 were delivered to the boats and 240 received from them. The marine post office which has been at the foot of First street for the past 15 years is now located at the foot of Third avenue, and has been put upon an all-year basis, being open both summer and winter. Heretofore the office closed when navigation was over. The business has so developed that the marine office now employs seven carriers, four clerks, two captains and two engineers. The showing made in 1914 is low in comparison with former years, but that was due wholly to the lessened number of boats moving, the office serving 7,456 boats less during 1914 than 1913.

Lake Michigan Ore Receipts

In former years Lake Erie was the sole ore receiving lake, but of late years the establishment of steel works at the foot of Lake Michigan has caused that lake to become a considerable factor as an ore-receiving lake. It is, in fact, growing in importance annually in that respect. During 1910 Lake Michigan ports received a total of 7,452,084 gross tons. During 1911, which was a year of lessened movement generally, Lake Michigan received 5,558,458 tons. Its growth is therefore very clearly illustrated in its share of the 1914 movement which was in round figures approximately that of 1911. Yet during 1914 Lake Michigan received 6,109,019 tons. During 1912 its receipts were 8,357,070 tons and during 1913, 8,701,832 tons. Its 1914 movement was distributed as follows:

Port.	Gross Tons.
South Chicago, Ill.	3,606,587
East Jordan, Mich.	38,158
Boyne City, Mich.	50,098
Elk Rapids, Mich.	28,437
Milwaukee, Wis.	93,121
Indiana Harbor, Ind.	661,054
Gary, Ind.	1,631,564
Total	6,109,019

David W. Taylor, naval constructor, has been appointed chief constructor of the United States navy. Naval Constructor Taylor is an architect of world-wide reputation.

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Coal Movement During 1914

The coal movement on the Great Lakes during 1914 exhibits a drastic subtraction from the movement of 1913. The total movement of both hard and soft coals during the year was 27,280,228 net tons as against 33,362,379 net tons for the year 1913, a decline of 6,082,151. Both Lake Superior and Lake Michigan movements suffer in about equal proportion. The soft coal cargoes shipped during 1914 amounted to 21,840,000 tons to which is to be added 1,155,000 tons of fuel coal, making the total soft coal movement to Lake Erie ports 22,995,000 tons. The hard coal shipments totaled 4,285,228 net tons, so that the total lake shipments were 27,280,228 net tons. Hard coal shipments during the past ten years have been as follows:

Year.	Net Tons.
1914	4,285,228
1913	5,033,696
1912	4,204,741
1911	3,917,419
1910	3,639,368
1909	3,052,706
1908	3,538,098
1907	3,449,695
1906	2,681,808
1905	2,785,362

Regarding soft coal shipments, the decline was almost wholly confined to the Ohio field which, as is well known, was practically idle all year owing to labor and other disturbances. While the Ohio field shipped 6,176,624 net tons in 1913 it shipped only 1,363,000 tons in 1914, a decline of 4,813,624 tons. Soft coal shipments from the Virginia field were 9,106,000 tons in 1914 as against 8,736,586 tons in 1913, an increase of 369,414 tons. Shipments from the Pittsburgh district declined 2,220,473 tons. The lake tonnage of soft coal from all districts for the past fourteen years is shown in the accompanying table.

Soft Coal Lake Tonnages in 14 Years

Year.	Pittsburgh.	Ohio.	Virginia.	Total.
1901	3,795,706	1,954,825	787,572	6,538,103
1902	4,704,093	2,689,934	965,769	8,359,636
1903	6,092,047	2,458,265	1,539,435	10,089,747
1904	6,058,383	2,138,247	1,279,876	9,476,506
1905	7,443,883	2,062,692	2,109,262	11,615,837
1906	9,237,272	2,560,906	2,743,732	14,591,910
1907	10,549,995	4,074,296	3,420,941	18,037,232
1908	8,700,000	3,600,000	3,450,000	15,750,000
1909	8,687,395	3,002,815	3,874,570	15,564,690
1910	11,911,900	4,297,300	6,629,500	22,838,700
1911	10,611,941	4,019,544	7,151,200	21,782,685
1912	11,300,000	4,676,000	7,360,000	23,335,000
1913	13,415,473	6,176,624	8,736,586	28,328,683
1914	11,195,000	1,363,000	9,106,000	22,996,000

These figures include 895,000 tons shipped from the Kentucky district and 436,000 tons shipped from Pennsylvania districts other than Pittsburgh during 1914.

Commerce of Lake Superior

The report of the superintendents of the canals at Sault Ste. Marie shows that 18,717 vessels of 41,986,339 net tons register passed through the canals during 1914. Of this number 12,639 of 24,690,381 net tons register used the United States canal and 6,078 vessels of 17,295,958 net tons register used the Canadian canal. The total freight movement was 55,369,934 net tons, which was almost equally divided between the United States and Canadian canals. The amount passing through the United States canal was 27,771,467 net tons and the amount passing through the Canadian canal was 27,598,467 tons. It should be noted that more than twice as many ships passed through the United States canal than through the Canadian canal and the figures show conclusively that the Canadian canal handled most of the big carriers. This condition will undoubtedly be the reverse in 1915 when the new Davis lock will be continuously in operation. The United States canal opened on April 20 and closed Dec. 17, a season of 242 days. The Canadian canal opened April 20 and closed Dec. 14, a season of 239 days. Following is the summary of freight carried through the canal during the season of 1914:

Items.	Total Traffic for Season 1913.	Season 1914.	Increase or Decrease Amount.	Per cent. Inc.	Dec.
Vessels:					
Steamers, number	19,789	14,994	4,795	..	24
Sailing, number	1,992	1,682	310	..	16
Unregistered, number	2,014	2,041	27	1	..
Total, number	23,795	18,717	5,078	..	21
Lockages, number	16,867	13,502	3,365	..	20
Tonnage:					
Registered, net	57,989,715	41,986,339	16,003,376	..	28
Freight, short	79,718,344	55,369,934	24,348,410	..	31
Passengers, number	77,194	59,801	17,393	..	23
Coal:					
Hard, short tons	2,744,574	2,240,505	504,069	..	18
Soft, short tons	15,878,364	12,246,716	3,631,648	..	23
Flour, barrels	10,212,667	9,715,085	497,582	..	5
Wheat, bushels	204,821,507	150,284,095	54,537,412	..	27
Grain, bushels	112,230,369	68,338,072	43,892,297	..	39
Mfd. and pig iron, short tons	402,912	239,683	163,229	..	41
Salt, barrels	730,431	777,208	46,777	6	..
Copper, short tons	85,378	91,764	6,386	7	..
Iron ore, short tons	48,109,353	31,413,765	16,695,588	..	35
Lumber, M. ft. B. M.	599,586	452,148	147,438	..	25
Building stone, short tons	6,181	.....	.....	..	100
General mdse., short tons	1,770,860	1,317,304	453,556	..	26

Interlake Steamship Co's. Operations

The report of the operations of the Interlake Steamship Co. which was submitted to the directors in December indicates a most remarkable condition of affairs, not only setting a very high mark for other companies but one which it will be difficult even for the Interlake company to achieve again. This company operates 35 steamers and two barges and they came through the season with damage and wrecking bills totalling only $3,700, which works out at $100 per vessel. This fleet is operated without insurance. If insurance had been carried the premiums would have amounted to $350,000. This entire sum, therefore, can practically be added to the insurance fund. This result could not have been achieved without team work of the highest order and the officials of the company give full credit to the officers of the ship for their share in the performance. Only two ships required assistance throughout the season. One of the steamers grounded in the St. Clair river, owing to low water, and another steamer went on Peshtigo reef, involving a wrecking bill of $1,500.00. During the season the 35 steamers averaged about fifteen round trips and delivered about thirty cargoes, as they were loaded both ways practically every trip. The directors declared a quarterly dividend of 1½ per cent, payable Jan. 1.

Mr. Shane Heads Towing Co.

Samuel P. Shane was elected president of the Great Lakes Towing Co. at a meeting of its board of directors in December. Mr. Shane is a railroad man of long experience and was the receiver for the Gilchrist Transportation Co. Captain Johnson, who has been identified for many years with the operating end of the Towing company, was elected vice president. The property of the company is in excellent shape, practically all of the old wooden tugs having been replaced with steel ones.

Alexis C. Angell has been elected director of the Detroit & Cleveland Navigation Co. vice George M. Black, deceased. Mr. Angell is the head of the law firm of Angell, Boynton, McMillan, Bodman & Turner, Detroit.

The annual meeting of the Lumber Carriers' Association will be held at Hotel Normandie, Detroit, on Jan. 19.

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Isherwood System of Construction*

Showing the Arrangement of Framing in the Engine Space Extending From Frames 24 to 30

By Robert Curr

THE plan herewith shows the arrangement of framing in the engine space which extends from No. 24 to No. 30. The water ballast runs to No. 29 cross frame which is solid and watertight.

No. 24 bulkhead is not shown, only the longitudinals which are riveted to it.

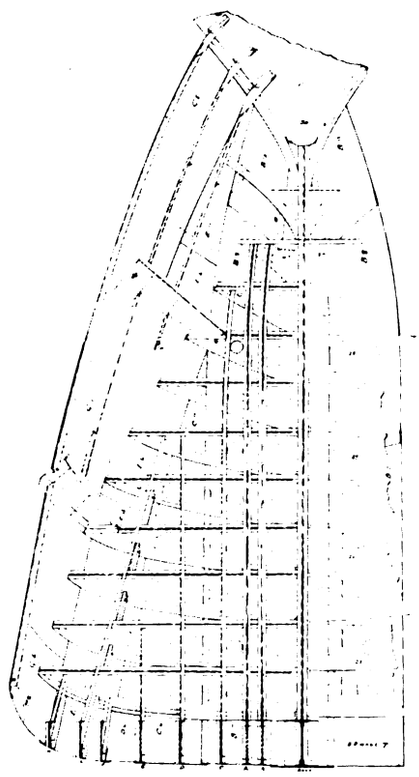
The longitudinal "A," next the center keelson forms one of the girders for the engine foundation. Between "A" and "C" longitudinals an extra girder "A1" is fitted to suit the engine foundation.

On the port side part of the floor plates are shown, so that the arrangement of the two girders may be seen.

The floor plates are scored out for half their depth, likewise the girders "A" and "A1," so that the girders are intercostal in the bottom and the floor plates on top. By this arrangement the girders are locked into the floor plates and connected with angles on each side.

This is Mr. W. I. Babcock's idea in building engine foundations.

Instead of having intercostals in way of the engine the materials are arranged as shown by "A" and "A1," which leaves no loose work and makes a splendid foundation for the machinery. It may be observed that if Mr. Babcock had scored out the floor plates in the bottom instead of the top there would have been no Isherwood System.



TRANSVERSE AND LONGITUDINAL FRAMING IN ENGINE SPACE

The longitudinal frames can be run in to suit any girder arrangement in the engine room as shown by the plan herewith.

"C" longitudinal runs to between Nos. 28 and 29. "D" to No. 27, "E" to No. 25, "F" to between Nos. 24 and 25, "G" to No. 27, and "H" between Nos. 24 and 25. "H" longitudinal being near the tank margin flange to the shell is stropped for practical purposes and begins again immediately before deep transverse No. 28 and is continued to bulkhead No. 30. "K" longitudinal takes the line of the tank to No. 24, when it becomes the tank margin.

At No. 26 transverse "K" longitudinal begins again and continues to after peak bulkhead No. 30. "M" longitudinal is continuous from the stem to No. 30.

The transverse in the bottom under the engines are spaced 3 feet 2⅞ inches apart and the longitudinals are continued as far as practicable. This arrangement shows easy access and roomy, which goes a long way to facilitate repairs and keeping the bottom under engines clean.

*This is the twentieth of a series of articles on the Isherwood system of construction which began in the September, 1912, issue of THE MARINE REVIEW. The first article dealt with the general specifications of the steamer; the second with the sheer, half-breadth and body plans; the third explained the method of getting the sheer; the fourth dealt with the longitudinal and transverse framing; the fifth with offsets; the sixth with the shell plating; the seventh with the shell plating expansion; the eighth with the arrangement of plates and angles forming the spar deck; the ninth with the transverses; the tenth with bulkhead construction; the eleventh with the connection of longitudinal frames to the bulkheads and transverses; the twelfth showed the interior framing between the tank top and spar deck; the thirteenth showed the amount of work that can be put together in a Great Lakes ship yard in a few hours; the fourteenth showed details of riveting in shifts of butts; the fifteenth considered the subject of butt straps and laps; the sixteenth discussed Lloyds rules and their application; the seventeenth shows certain details of the transverse and longitudinal system; the eighteenth gave calculation for the neutral axis and moment of inertia for the transverse framed vessel; the nineteenth showed the materials in the section of the Isherwood vessel.

Grain Trade of Lakes

The grain trade of the Great Lakes was considerably less during 1914 than 1913, the grain shipped during 1913 amounted to 403,360,346 bushels or 11,697,160 net tons, as against 337,718,949 bushels or 9,793,850 net tons in 1914. In arriving at the number of net tons, 58 pounds per bushel has been taken to represent a general average for all grains. While the subtraction is considerable for these two years, it must be borne in mind that it was not until 1912 that the grain trade of the Great Lakes passed the 300,000,000 bushel mark. The trade has grown phenomenally during the past few years and can be confidently expected to grow as time goes on. Figures for the past decade are shown in the accompanying table.

GRAIN TRADE OF THE LAKES FOR THE PAST DECADE

	1914.	1913.	1912.	1911.	1910.	1909.	1908.	1907.	1906.	1905.
Lake Superior.....	218,622,167	317,051,875	243,110,902	137,924,520	125,505,459	159,773,012	149,500,456	141,599,113	138,614,513	107,550,841
Chicago	89,791,000	55,180,000	47,608,600	73,323,100	57,160,600	41,064,866	38,839,907	66,212,264	60,935,993	68,422,821
Milwaukee	10,875,683	11,867,798	16,655,248	20,198,171	10,894,059	18,811,935	8,390,223	20,674,914	19,061,304	18,439,202
Other ports.....	18,430,099	19,250,672	15,806,389	8,535,765	6,561,053	9,703,490	11,010,600	13,270,154	18,045,691	16,375,388
Total	337,718,949	403,360,346	323,181,139	239,981,556	200,121,171	229,353,303	207,741,186	241,756,445	236,657,501	210,788,252
Totals in net tons..	9,793,850	11,697,160	9,372,252	6,959,465	5,803,514	6,651,245	6,024,493	7,010,937	6,863,068	6,112,859

The C. F. Harms Co., 17 South street, New York, general agents for scows, dumpers, covered and derrick barges, have just issued their tide calendar for 1915, showing high and low water at Sandy Hook, Governor's Island and Hell Gate. A tide table is also given for all places from Maine to Florida.

Charles A. Moore, president of the Manning, Maxwell & Moore Corporation, died on board the steamship Rotterdam en route to Rome Dec. 8. He had spent the last three winters in Italy on account of his health. Mr. Moore lived a very active life and was eminently successful as a business man. The corporation which he founded controlled the Consolidated Safety Valve Co., the Hayden & Derby Mfg. Co. and the Shaw Electric Crane Co.

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United Fruit Service

A new note in advertising has been struck by the United Fruit Co. in its latest publication "The Story of a la Carte.". A painstaking effort has been made to trace the history of sea dining; and from the times of the ancient Egyptians down to the ships of the Great White Fleet the story is well told in illustrations and quotations from ancient manuscripts.

In the booklet are delightful little water colors of ships of Egypt, Rome, Norse Vikings, the quaint warships of Henry VIII, the Armada, clipper ships and modern steamships. The food and life aboard the ships are well described, and the transition from the primitive fare aboard a Roman galley and a modern ship is well worked out.

The book is intended primarily to exploit the a la carte service aboard Great White Fleet ships, but it does more than this; it explains and gives historical references for many little known facts about dining and life at sea, and the casual reader who picks up the book will undoubtedly read it through.

Southern Bedding Co.

The Southern Bedding Co., 623-633 West Pratt street, Baltimore, announces that they have acquired all of the stock, patents, patterns, etc., of John P. Lein & Sons, New York city, manufacturers of ship berths, and have added this equipment to their marine department.

The Southern Bedding Co. is one of the associated companies of the Rome Metallic Bedstead Co., and are among the largest manufacturers of metal beds, spring beds and metallic couches in the country. With a complete plant equipped with modern machinery it is proposed to develop the end of the line pertaining to ship berths to the same high state of excellency to which they have brought their line of metal beds and springs. New catalogues are in course of preparation, which will be gladly mailed upon request.

Alterations to Saranac and Tuscarora

The steamers Saranac and Tuscarora, of the Lehigh Valley Transportation Co.'s fleet, are undergoing extensive alterations at the Great Lakes Engineering Works' Ecorse plant. The work includes complete new boiler installation with positive hot draft; removal of independent and substitution of attached auxiliaries; alteration of main engines, valve gear, etc. Plans and specifications were prepared by Babcock & Penton, Cleveland and New York, and the work is proceeding under their supervision.

Each ship is receiving two boilers 13 feet, 8 inches diameter, 10 feet 6 inches long, which are being constructed by the Detroit Ship Building Co. Sirocco fans, direct-driven by Terry turbines, will be furnished by the American Blower Co., for supplying air to the draft system. These turbine-driven units have proven very suitable and satisfactory for marine work because of the small space required, light weight, economy and convenience of operation.

Both ships are to be completed by April 1, 1915.

The steamer W. L. Brown, of the Republic Transportation Co.'s fleet, is also receiving alterations at Manitowoc under the direction of Babcock & Penton, consisting of removal of one of her three boilers, shifting the others and equipment with induced heated draft.

Forecast of Oakum Business

The year 1914 has been a most unusual one in the oakum business. To a greater extent than ever before in the memory of the present generation, has it been filled with anxieties, uncertainties and abnormal conditions. So many industries use the European situation as an excuse for raising prices when as a matter of fact they are not materially affected, that many who offer such reasons are looked upon with suspicion. The oakum business, however, was one of the very first to feel the affect of the European war and this will be readily understood when it is explained how dependent this industry is upon the countries of Europe.

In the first place all oakum is made entirely of soft fibre. It contains no manila, sisal, isal, New Zealand, or any other fibres which are classed as hard, harsh or wiry. This soft fibre, insofar as marine oakum is concerned, is made up almost entirely of the hemps and hemp tows, which are grown in Russia and Italy and the products made of such soft fibres such as old hemp ropes, like rigging, bolt rope and lanyards. Sometimes small quantities of soft fibre hemp which is grown in India are also used, but only certain qualities of this are capable of being utilized for this purpose. American grown hemp and flax, and Canadian flax are also used, but the nature of this hemp, as well as its color and the impossibility of cleaning the flax without too great a loss and expense almost eliminate these fibres as influencing factors in the manufacture of oakum.

Thus it is seen that the American manufacturer is dependent upon importations of this new raw material from Russia, Italy and India. The hemps of these countries are used for making most of the cordage used in all of the European countries and when this cordage becomes too weak to stand the strain of its normal work, with a certain degree of safety, it becomes known as oakum rope, and almost all of this kind of rope finds its way to this country. Most of the shipments of this material come from Germany, Belgium, France, Holland, England, Scotland, Norway and Sweden.

As a natural sequence of war conditions in the countries where the largest supply is normally obtained all quantities, qualities and prices immediately became very uncertain and the manufacturers here felt the change at once, as the stocks on hand were low at all of the factories with hardly an exception. England had for a while, and Germany has now, an embargo against the exportation of this material while some shippers in Holland have lain down on their contracts until the end of the war. Meanwhile, ocean freight rates as well as insurance rates increased several times.

Before the beginning of the war, this industry was affected like most all others by the radical and uncertain changes in our national legislation, particularly the tariff and by the Mexican situation, as considerable oakum is exported to that country. Extreme depression, from above causes, was felt in the oakum business as early in the year as February, and lasted until the end of July, during which time the average sales per month were about 26 per cent in volume under the same months in 1913. This was a real depression. There was nothing theoretical or psychological about it.

There was great improvement in the demand from the last few days of July to the first week of September, making August the best month of the year. This demand, however, fell off so quickly that both September and October proved to be considerably under a fifteen years average and November recorded itself as the poorest month in the whole year.

With variations of course, but nevertheless with considerable certainly, the consumption of oakum in this country is steadily declining and has been for many years. Thus as the consumption has decreased gradually have a number of the factories failed or voluntarily closed up as they found it impossible to secure enough business to make a living or have been unable to compete against their more up to date and more advantageously situated competitors, until only a few survive the many who formerly turned this product out. Even of these remaining, a few have found it necessary to spread out into kindred lines of manufacture and thus we find

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makers of oakum are also makers of friction, trunk, and binder boards, jute packing, caulking cotton, sheathing felt, and even shredded bagging for upholstery purposes and still the oakum production is at least equal to the demand, probably nine tenths of the times.

Combined with this situation, the manufacturer here has always had to face the importation of oakum from his foreign competitors, who are still many. This oakum has been brought into the country in large quantities at different times and places but never with any great degree of success, on account of its inferior quality. The chief efforts along this line were made in New York, Boston, Philadelphia, Baltimore, Cincinnati, Cleveland and New Orleans.

The reasons for the failures of all these attempts to market foreign made oakum lie in both the different processes of manufacture here and abroad as well as in the different classes of raw material entering into the products. Foreign and domestic oakums are so dissimilar in texture, finish, length of fibre, color, feeling, and odor, that most anyone who has handled oakum at all can immediately tell the difference.

It is very difficult at this time to forecast the outlook for 1915. Much depends upon the raw material situation in Europe. Nothing can help the demand for oakum more than good legislation allowing a ship subsidy along the lines on which the great English and German steamships are run.

American Head of Cunard Line

With the advent of the new year an interesting and important event in the American management of two of the oldest transatlantic lines has taken place—Charles P. Sumner, the general agent of the Cunard line here for the past five years, taking over the management also of the Anchor Line upon the retirement of William Coverly from the latter.

Mr. Sumner's active experience in connection with maritime affairs of over 40 years will stand him in good stead in assuming the additional duties and responsibilities. As a native of Boston, he was early connected with the Warren Line, was the founder and owner of the Sumner Line between New York and Liverpool—the first line of importance exclusively devoted to the carriage of freight and live cattle between these ports.

As one of the most active and influential members of the New York Produce Exchange, Mr. Sumner served for many years as chairman of the complaint committee, and his resignation of that important post in January, 1904, on his removal to Boston to become the agent there of the Cunard Line, was much regretted. To his indefatigable efforts as chairman of the joint committee of members of the New York, Boston and Philadelphia exchanges was largely attributed the success of the fight for the removal of the board of trade restrictions of W. N. A. load line for British steamers loaded in American ports north of the Chesapeake.

His management of the Boston agency of the Cunard Line was most successful and led to his appointment to the general agency here upon the resignation of the late Vernon H. Brown.

Mr. Sumner's administration of the two lines will be watched with interest but no doubt as to the successful result exists in the minds of his friends. His thorough study and intimate knowledge of the technical and physical working of ships, the best utilization of space for cargoes, etc., have resulted in the adoption of the most modern methods and means, making of the Cunard piers models whose operations are watched and followed by the trade.

Though beset with difficulties during past troublous months because a majority of their vessels have been requisitioned by the British government, thus severely curtailing facilities to Liverpool, the Cunard Line have maintained a regular service with their popular Lusitania, Franconia, the new Orduna and Transylvania and by the charter of a number of fine freight vessels, and Mr. Sumner is most sanguine not only of upholding the old-time prestige of the Cunard Line, but of achieving similar success with the Anchor Line.

The Gas Engine & Power Co. and Charles L. Seabury & Co., Morris Heights, New York, is in receipt of a letter from President W. L. Gazzam, of the Kitsap Transportation Co., Seattle, stating that the Seabury engines and boilers placed in the steamers Hyak and Kitsap have proved very satisfactory. Mr. Gazzam states: "As you are aware, the first cost of these engines and boilers was higher than that of other competing makes, but we believe that they are much cheaper in the long run, as our experience is that repairs on other makes argue largely in favor of the Seabury equipment."

Barge Loading Dredge

W. Simons & Co., Ltd., launched Nov. 20, 1914, with all machinery on board and with steam up ready for work, the barge-loading bucket dredger "T. C. C. No. 9," built by them to the order of the Tees Conservancy Commission. The vessel which has been specially designed for work on the Tees is very well equipped for dealing with all classes of material and is capable of dredging to a depth of 45 feet below water level. A set of compound marine type engines supplied by steam from two multitubular steel boilers constructed for a working pressure of 130 pounds per square inch, drives the dredging machinery, the gearing wheels of which are all machine cut. Suitable clutches are provided so that the engines may be engaged with or disengaged from the dredging gear or the propelling gear as required. The engines are arranged to give two speeds of buckets so that a constant piston speed is maintained when the dredger is working either in soft or hard ground.

The deck machinery includes steam gear for raising and lowering the bucket ladder; powerful bow and stern winches for maneuvering purposes, and for regulating the cut of the dredger while at work.

Coal Unloading Machinery

The Cleveland & Erie Machinery Co., Cleveland, have sold a pair of large steel braces, now located at Ashtabula Harbor, Ohio, for erection in one of the northern coal ports, for unloading coal from vessels. A similar outfit has been furnished the New Ontario Dock Co., at Sault Ste. Marie, Ont., Can., which has been working very successfully.

The buckets on these bridges were designed to handle about 2-ton of coal but it was found, upon investigation, they handled three and possibly better. The buckets are being furnished by The G. H. Williams Co., of Cleveland, Ohio.

It is announced that when the naval fleet goes to San Francisco next year as a part of the Panama-Pacific exposition program, it will be accompanied through the Panama canal by the Louisiana naval militia. The men will be taken aboard the vessels of the reserve fleet and will have the same status as the regulars. All expenses of the trip will be met by the federal government.

Secretary Daniels of the Navy department has announced that the Pensacola yard is to be maintained as an aviation station and the repairing that was formerly done at this yard will go to New Orleans. All gunboats, small cruisers, army transports, auxiliary ships and revenue cutters are to be repaired at the New Orleans yard.

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A Stoker for Scientific Firing

Details of a Mechanical Stoker Designed to Charge the Furnace Frequently With Small Amounts of Coal

"FIRE light and often" are the instructions given to firemen by engineers who are familiar with the conditions which tend to produce perfect and smokeless combustion in the operation of boilers. Owing, however, to the inherent weaknesses of human nature, very few firemen follow these instructions with any noticeable care. In order to eliminate the inaccuracies on hand firing, mechanical stokers have been introduced. One of the latest devices of this kind is that developed by the Kincaid Stoker Co., Cincinnati. This machine, it is stated, is capable of delivering charges of coal ranging from three ounces to two pounds, according to the capacity of the furnace to which it is attached. The coal is distributed evenly over the grate at the rate of 10 to 75 charges per minute, depending on the requirements of the boiler. This is said to build up a fire which is light and spongy and gives an even and extremely high temperature over the grate.

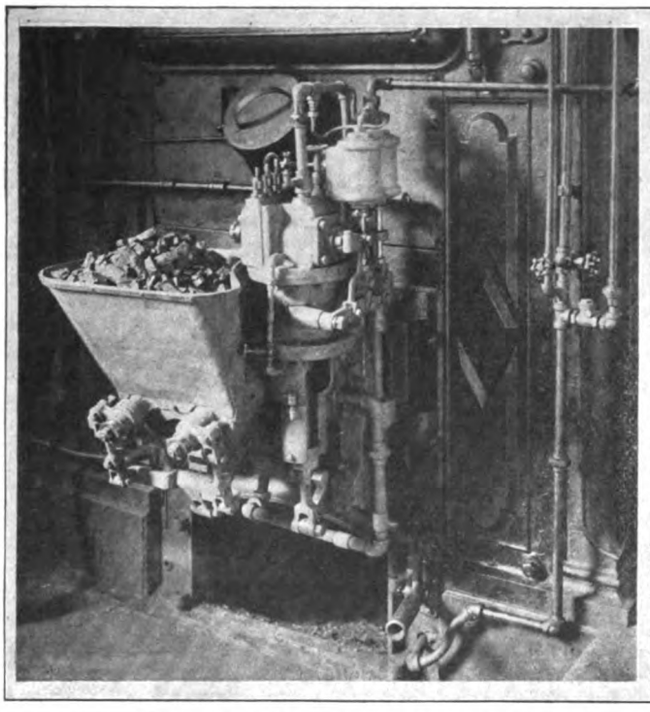

FIG. 1—AUTOMATIC COAL STOKER IN OPERATING POSITION

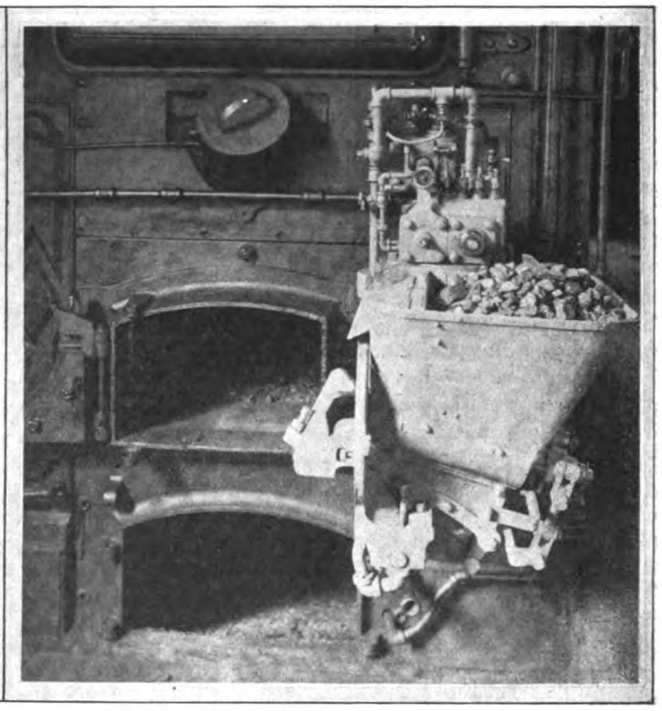

FIG. 2—STOKER SWUNG AWAY FROM BOILER FRONT FOR CLEANING OR INSPECTION

Fig. 1 shows the stoker in operating position. The entire apparatus is hinged on a frame bolted to the front of the boiler, and no change in the setting or boiler front is required other than the removal of the fire door and the attachment of the stoker. The stoker may be swung clear, as in Fig. 2, for cleaning the fire or for any other occasion that may arise.

The device is equipped with crusher rolls which make it possible to use coal of any size from slack to 8-inch lump. Also it is stated that mixed sizes, such as run of mine, can be employed. The coal is forced into the furnace by a ram which is actuated by a steam piston. The ram is fed by two worms situated in the bottom of the hopper. They work intermittently so that when the ram is delivering a blow against the coal, no coal is being fed forward. When the ram is withdrawn, the same motion actuates the worm through a predetermined portion of a revolution. Thus the same quantity of coal is fed to the ram for each successive blow. This quantity may be changed by changing the throw of the ratchet arm which controls the motion of the worms.

Steam is admitted to one side of the piston which drives the ram by means of a rapidly acting valve in much the same manner as air is admitted behind the piston of a pneumatic hammer. By means of a special throttling mechanism, the pressures of steam admitted behind the piston are successively varied so the strokes or blows of four different intensities are secured. Therefore the first or weakest stroke delivers a charge of coal over the front quarter of the fuel bed; the second stroke delivers into the second quarter, and so on. The spreading of the coal is accomplished by means of a distributor plate.

The exhaust from the ram cylinder is lead to a ⅜ x 3-inch rectangular nozzle situated immediately back of the distributor plate. The events are so timed that a blast of exhaust steam emerges from the nozzle at the same instant that a charge of coal reaches the distributor plate. This steam catches the coal and assists in spreading it over the various portions of the fuel bed. The intensity of the blasts of exhaust steam vary in the same manner and directly with the intensity of the strokes of the ram. The character of the spreading depends upon the contour of the distributor plate which is varied to suit furnaces of different shapes and proportions.

The fluctuations in the demand on the boiler are accommodated by varying the number of charges of coal thrown per minute and by varying the size of individual charges. The former is the principal method employed, while the latter is resorted to only in cases of extreme variation. The change in speed is accomplished by means of a small steam pilot piston, the speed of which is con-

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trolled by a water-resistance piston to which it is yoked. The resistance of the water piston is varied by constricting or enlarging the passage through which the water is forced to flow from one end of the cylinder to the other. Because of this arrangement, it is said that both hand and automatic control are easily accomplished.

Terrestrial Magnetism

Terrestrial magnetism was the subject of a paper delivered before the members of the Institute of Marine Engineers. The paper was prepared by A. N. Somerscales.

The author, in the course of his paper, said:

"I feel that some apology is due from me in bringing this paper before an Institute of Marine Engineers. The art or science of marine engineering may certainly be extended in the future to cover a great deal more than it has covered in the past, or that it covers at the present time, but in order to make it cover terrestrial magnetism it must extend its mantle over the whole earth, for terrestrial magnetism is the study of the magnetic properties of the earth considered as a magnetised globe. And yet, although one cannot claim that the subject has any kinship with engineering pure and simple, its relation to the sea is very intimate indeed. Navigation is dependent upon terrestrial magnetism for its daily, nay, for its hourly needs and practice. What would navigation be—one might very well ask—without the mariner's compass?

Science of Navigation

Is it not as well that some of the leading principles of the science of navigation should be familiar to the marine engineer, and at the same time that some of the science of engineering should be known to the deck officers? Let me first remind you of the elementary facts about magnetic attraction and repulsion, and a few definitions of terms. By a "magnet" is meant something that has become magnetized. All substances are not susceptible of magnetization. Those that are susceptible are said to be magnetic substances. The principal ones are iron and steel, but iron ore Fe3 O4, nickel, cobalt, oxygen gas and others, are slightly magnetic. It is important to distinguish between a "magnetic substance" and that same substance when magnetized. A bar of iron is called magnetic in virtue of its power of receiving magnetism, but it is not a magnet until it has been magnetized. The full name for these bodies is paramagnetic. The phenomena of diamagnetic bodies is not considered here. One method of magnetizing a bar of iron or steel is to pass an electric current round it many times, producing the well known electromagnet. If the steel has previously been hardened it will remain a magnet after the current is cut off—perhaps for many years. But if unhardened or if the bar is of soft iron, the magnetism is not retained after the current is cut off, or only to a slight extent

"Now let us suppose that we have several bars of hardened steel magnetized by insertion in a coil in the above manner. If the ends of the bars are marked in some manner to distinguish those which were pointing through the coil in the same direction, it will be found that there is a strong repulsion between the marked ends of any two bars or magnets. Also a strong repulsion between the unmarked ends. But upon presenting the marked end of one bar to the unmarked end of another a strong attraction results. This phenomenon is expressed in the great law that like poles repel each other and unlike poles attract each other.

"The poles of a magnet are the spots where the attractive or repelling force is a maximum. At the middle point in the length of a bar magnet there is no force perceptible. But if the bar is broken across at the center, each half becomes a perfect magnet, with two poles of opposite natures. By no device can one pole in a manner be isolated. Hence magnetism must be considered as a dual force. There are apparently two kinds which have been distinguished in various ways. Some writers have called them plus and minus. Some red and blue. The most usual names are north and south. The latter names have arisen owing to a property of a magnet to set itself in a north and south direction when suspended on a sharp point, or hung by a thread of untwisted silk. One of the most remarkable things about magnetism is that from one magnet any number of magnets can be made without any diminution of the strength of the original. It is only necessary to hold a piece of iron or steel for a short time in contact with a magnet to become itself a magnet. If the piece of steel is first hardened its acquired magnetism will be permanent, but if not hardened it will vanish soon after, or immediately upon being separated. It is not even necessary that actual contact should take place, although the effect is much less in this case. The effect is called 'induction', and the law of induction is that a N. pole induces a S. pole, and vice versa.

"I have spoken of the property possessed by a magnet of setting itself in a north and south direction. Now this experiment or property brings me at once face to face with terrestrial magnetism. The question is what makes a magnet set itself north and south when suspended on a point?

The Mariner's Compass

"The question remained unanswered for three or four centuries during which the compass was used in Europe, until a Dr. William Gilbert, in the year 1600 published his work on 'the magnet'. Gilbert said the needle points to the pole in obedience to the law of unlike poles attracting each other. The compass needle is one magnet. The earth itself is the other magnet. At the North Pole of the earth there is magnetism of the opposite kind to that at the north end of a compass needle, and therefore the needle is attracted that way. The south end of the needle is directed to the South Pole for a similar reason. It is a little unfortunate that we give the same name to one kind of magnetism that we give to one hemisphere of the earth, because it makes it appear as if north magnetism attracted its like instead of its unlike. The fact is we have to keep in mind that the magnetism in the northern hemisphere is of the kind called south, and that the magnetism in the southern hemisphere is of the kind called north. The behavior of a compass needle can only thus be accounted for on the law of north attracting south.

"Now, very early in the history of the mariner's compass it was found that the needle did not lie truly north and south. This discovery dates from the time of Columbus. The needle sets itself at an angle horizontally with the geographical meridian or true north and south line. The angle varies in different parts of the world, and is known to seamen as the variation of the compass. Another way of expressing the fact is to say that the needle points to the magnetic pole of the earth, but not to the geographical pole.

"The history of the mariner's compass from the time when the needle of soft iron required repeated applications of the 'lodestone' to preserve its magnetism, to the very perfect instrument of the present day—the Kelvin compass—is a most interesting story. But the compass is only alluded to in the present article be-

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cause it happens to be the chief, if not the only instrument by which terrestrial magnetism is detected. Hence, in every magnetic observatory the instrument used consists of compass needles variously mounted, to show the changes in the total force, and in the 'variation'—which, by the way, is known in the observatories under the name of 'declination'—and the dip. Very small and light needles are sometimes used.

Variation of the Compass

"The 'Variation of the Compass', also known as the 'Declination of the Compass', is the angle between the magnetic meridian and the geographical meridian in any locality. But the ordinary charts giving the variation in different parts of the world, although indispensable to the navigator, are not the best charts from which to study the distribution of terrestrial magnetism. Before magnetic observations were established many isolated observations were recorded of the variation of the compass in different parts of the world. These, together with the subsequent more systematic records, form a continuous history of what is called the 'secular change in the declination'.

"The simplest experiment to show induction from the earth is made with a kitchen poker. Hold the poker vertically, give it a tap with a hammer, or jog it once or twice upon the hearth to shake the magnetism up, and it will be found to exhibit polarity; the upper extremity will have south magnetism proved by it attracting the north end of a small pocket compass held near it. The middle of the poker will be neutral and the lower extremity a North Pole, proved by its repelling the north of the compass. If the poker is now carefully inverted it will usually retain the same polarity when upside down for some time, but upon being tapped as at first the upper end will at once take south magnetism as the former upper end did. In other words, the upper end of any vertical bar acquires from the earth south magnetism and attracts the north end of the compass needle.

"Vertical iron produces what is called 'semi-circular deviation'. Horizontal iron produces 'quadrantal deviation'. This means that in one case the deviation produced changes from east to west or west to east when the ship's head moves through 180 degrees, or half round the compass, whereas in the other case the change from east to west or west to east occurs every 90 degrees, or four times in a complete circle. Now, in addition to the induction in individual bars or plates of iron fairly near a ship's compass, it is found that an iron or steel ship acquires while building a distinct magnetic polarity as a whole, and this character is found to be preserved for some considerable time after launching. This retentive character is no doubt due to mechanical treatment, such as the hammering and riveting which every part is subjected to on the ship.

"The condition to aim at in compensating a compass, and a condition actually brought about in a successful operation, may be described as creating a kind of charmed circle or sphere round the compass needles—perhaps a space no larger than a lamp globe—but a space in which no lines of magnetic force exist except those emanating directly from the earth's magnetism. All others due to the iron in the ship having been as it were wiped out in that small area. Such a compass will remain compensated even if the ship proceeds to southern latitudes, so long as the sub-permanent magnetism of the ship remains the same.

"With these scattered and very incomplete statements of the nature of the magnetic character of iron ships and the effect on ships' compasses, I must conclude this paper. If I have shown the great practical importance of a study of terrestrial magnetism, or even explained some of the terms used, it is perhaps as much as one can hope to accomplish in a single lecture."

Mulholland Door and Shutter Fastenings

Capt. M. Mulholland, of the steamer M. A. Bradley, has an uncommon inventive turn of mind and has designed during the past few years a number of useful devices for aid aboard ship. His latest achievement in this direction lies in designing a set of suitable fasteners for storm doors and shutters. The steamboat inspection service ruled last year that the wooden doors and windows of deck houses on lake steamers would have to be fitted with storm doors and shutters in order to withstand hammering by the seas in heavy weather. Capt. Mulholland has, therefore, designed fasteners for both doors and shutters. The door fastener consists of malleable iron battens riveted on the inside of the door, the rivets going through a sheet of galvanized iron which covers the outside of the door. The battens fit at each end into the malleable sockets provided with pins by which the door may be securely locked on the inside, if desired. The window shutter fastener consists of malleable battens which are riveted to the outside of the shutter and can be secured or released from the inside of the cabin by thumbscrews which engage malleable clamps by means of a rod passing through a ferrule in the window sill. A deadlight is set in the shutter so that abundant light can be admitted when the shutter is secured to the window. The fastenings are inexpensive and can be supplied on short notice.

The board of army engineers, Washington, recently announced the distribution of the $20,000,000 appropriation made by Congress for river and harbor improvements. Ohio rivers, locks and dams will receive $1,750,000. Other allotments for Ohio projects are as follows: Toledo harbor, $135,000; Port Clinton harbor, $500; Huron harbor, $12,000; Vermillion harbor, $3,000; Conneaut harbor, $243,530; Cleveland harbor, $150,000; Ohio river, open-channel work, $19,000; a total of $2,313,030 set aside for Ohio and Ohio river work.

The New Jersey Dry Dock Co., Elizabethport, N. J., is building a steel steamer for the Sanitarum Association of Philadelphia, to be 140 feet long. The engine for the steamer, cylinders 13 and 27 by 20 in., is building by the John W. Sullivan Co., while her boiler, 11 feet by 11½ feet, is building by the Harlan & Hollingsworth Corporation, Wilmington, Del. The new craft was designed by Cornell & Mathews, Philadelphia, and will run from Philadelphia to Red Bank.

The schooner Golden State of the Union Fish Co.'s fleet, engaged in the fishing industry between San Francisco and Pirate Cove, Alaska, is the largest motor-driven schooner on the Pacific coast. She was built in 1913 and is 138 ft. long, 31 ft. beam and 11½ feet deep. The schooner makes the run between San Francisco and Pirate Cove in from thirteen to fifteen days, whereas before the installation of the motor it required from twenty-five to 30 days to make the run.

The new steamer Peoria of the Eagle Packet Co.'s fleet, built at Howard's Shipyard, Jeffersonville, Ind., recently underwent a successful trial trip at St. Louis. The new steamer is 240 feet long and 38 feet beam. The machinery was supplied by Rowan & Sons Boiler Works and the St. Louis Iron & Machine Co., both of St. Louis.

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Lake Vessel Losses During 1914

VESSEL losses during 1914 totalled 28, of which 17 were steamers, 6 barges, 4 tugs and one dredge. Fire caused 15 of the losses, 6 foundered, collision 1, 3 ran ashore in thick weather, one ran aground on a bar and was pounded to pieces, one turned turtle while being towed, and one was beached to prevent sinking.

The loss of lives numbers 54. The steamer Benjamin Noble foundered in a heavy gale on Lake Superior on April 27, on the first trip of the season, carrying down her crew of 20. The schooner William Jamieson sank in Lake Ontario on April 29, drowning her crew of six. No further mortalities occurred until November 19 when the steamer C. F. Curtis with the barges Marvin and Peterson in tow were lost near Grand Marais, Michigan, in a heavy gale and snow storm, together with all hands. The crew of the Curtis consisted of 14 persons, including 2 women cooks. The crew of the Marvin consisted of 7, including one woman cook. The crew of the Peterson consisted of 7 persons, including one woman cook, making the total loss of lives on these three vessels 28.

The first vessel to be lost in 1914 was the barge Dorcas Pendell, which was destroyed by fire while lying on the beach at Harbor Beach, Lake Huron. The steamer R. L. Fryer burned at Marine City on April 28. The steamer City of Rome burned and sank in Lake Erie on May 7th. The steamer W. H. Gilbert was sunk in collision with the steamer Caldera in Lake Huron on May 22. The steamer Berthier burned at Montreal on May 25 and the steamer Emma Thompson burned on Ennis Island, Georgian Bay, on May 28. The passenger steamer Manistee burned at Grand Haven, on June 28. The steamer George Van Vleck burned near Outer Island, Lake Superior, on August 1. The steamer Tacoma burned at Ludington, Mich., on Aug. 23. The steamer Montana burned to the water's edge in Lake Huron on Sept. 7, the crew fortunately escaping. The fish tug Ora Endress turned turtle in Whitefish Bay while being towed to Grand Marais on Sept. 13. The steamer John Harper was destroyed by fire in the Detroit river on Sept. 29. The barge Mary N. Bourke sank in the Detroit river on Sept. 29. The tug Advertiser was destroyed by fire in the Niagara river on Oct. 7. The steamer Conestoga was so badly burned by fire at Milwaukee, on Oct. 30, that she will not be rebuilt on account of her age. The schooner Samuel K. Flint ran ashore off Rocky Point, Lake Huron, during a heavy storm on Nov. 6 and was pounded to pieces. The steamer Oscoda ran ashore, on Nov. 10, in a heavy snow storm near St. Helena island, Lake Michigan and became a total loss. The steamer Colonial sprang a leak in Rondeau Bay, Lake Erie, during the storm, on Nov. 13, and had to be beached to prevent sinking. She was pounded to pieces by the seas. The fish tug Don Mar foundered off Monroe Point, Lake Erie, on Nov. 19 but the crew was rescued. It was this storm that took down the steamer Curtis and her barges Peterson and Marvin. The steamer Lehigh ran ashore in the storm near Manistique, Lake Michigan, and was abandoned to the underwriters as a total loss. The tug Donald Mac ran aground on a bar in Lake Ontario and was pounded to pieces. The steamer I. J. Boyce burned near Put-in-Bay, Nov. 28.

The loss of 54 lives is highly regrettable. It is a rather high average and is the total of just two storms, one at the beginning and the other near the close of the season. It will unfortunately never be known what happened to the Noble as there were no survivors. The three little lumber vessels were unfortunately caught in a blinding snow storm with a shore to leeway. Only nine lives would have been lost on the great lakes during 1913, had it not been for the unprecedented gale of November of that year in which 235 sailors lost their lives, making the total 244. During 1912 the loss of life was 33, as against 51 for 1911, 40 for 1910 and 12 for 1909.

TABLE OF TOTAL LOSSES.

Name of vessel.	Cause.	Where lost.	Carrying capacity, gross tons.
Str. Benjamin Noble.	Foundered	Lake Superior, near Duluth	3,000
Str. Gilbert, W. H.	Collision	Lake Huron, off Thunder Bay Island	3,666
Str. R. L. Fryer	Fire	Marine City, Mich	3,000
Bge. Dorcas Pendell.	Fire	Harbor Beach, Lake Huron	600
Str. City of Rome	Fire	Off Ripley, N. Y	3,000
*Str. Berthier	Fire	Montreal	1,000
Str. Emma Thompson.	Fire	Ennis Island, Georgian Bay	400
Sch. Wm. Jamieson	Foundered	Lake Ontario	350
Str. Manistee	Fire	Grand Haven, Mich	....
Str. George Van Vleck.	Fire	Lake Superior near Outer Island	1,400
Str. Tacoma	Fire	Ludington, Mich	2,500
Str. Montana	Fire	Lake Huron	2,700
Fish tug Oro Endress	Sank	Whitefish Point, Lake Superior	....
Dredge Fraser	Fire	Pelee Island, Lake Erie	....
Str. John Harper	Fire	Detroit River	3,100
Bge. Mary N. Bourke.	Fire	Detroit	1,700
Tug Advertiser	Fire	Niagara River, off Lower Grand Island	....
Str. Conestoga	Fire	Milwaukee, Wis.	3,000
Sch. Samuel K. Flint.	Ran ashore	Off Sturgeon Point, Lake Huron	700
Str. Oscoda	Ran ashore	Lake Michigan, near St. Helena Island	1,000
Str. Colonial	Wrecked by storm.	Rondeau Bay, Lake Erie	2,200
Fish tug Don Mar	Foundered	Off Monroe Pt., Lake Erie	....
Str. C. F. Curtis	Foundered	Lake Superior	1,000
Bge. A. M. Peterson.	Foundered	Lake Superior	1,000
Bge. S. E. Marvin	Foundered	Lake Superior	1,000
*Str. Lehigh	Ran ashore	Mud Lake, St. Mary's River	3,000
Tug Donald Mac	Ran aground	Lake Ontario	....
*Str. I. J. Boyce	Fire	Near Put-in-Bay, Lake Erie	700

*Constructive total loss.

Accidents to Lake Vessels Since August

Date	Name of vessel.	Nature of accident.	Place.
Aug. 1	Str. Geo. H. Van Vleck	Fire, which started in cargo hold, practically destroyed steamer. Wreck sold.	Lake Superior, near Outer Isl.
Aug. ..	Str. Cabotia	Steering gear and stem damaged. Docked at Cleveland.	
Aug. 4	Str. R. R. Rhodes	Collided with Str. Kenora; considerably damaged; docked at Ogdensburg for repairs.	St. Lawrence river.
Aug. 5	Str. John Harper	Broke in two just forward of engine house and was beached; no disposition as yet made of wreck.	Detroit.
Aug. 5	Str. Alberta	Broke her high pressure piston; went to Collingwood for repairs;	
Aug. 9	Str. Windsor	while entering, hit the dry dock, damaging both dock and boat.	Welland canal.
Aug. 9	Str. Wahcondah	Crashed into locks; four gates swept away at Lock No. 12.	Welland canal.
		Ran aground owing to breaking of steering gear; docked at Kingston Aug. 21.	Little Rapids Cut, Soo river.
Aug. 11	Str. Stadacona	Struck and punctured No. 4 starboard tank.	Calcite, Mich.
Aug. 12	Str. Selwyn Eddy	Grounded; lightered	Little Current, Ont.
Aug. ..	Str. Kelley Island	Damaged in launching; four plates taken off.	Lorain, O.
Aug. 14	Str. Onoko	Cracked her cylinder and spent three weeks at Manitowoc shipyard making repairs.	
Aug. ..	Sand Str. Chas. Heiden	Docked at Ecorse; six damaged plates.	

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Aug. 18	Str. Northmount	Ran ashore; released after lightering 15,000 bu. grain; forepeak full of water; docked at Buffalo	Deer Isl., near Alexandria bay.
Aug. 21	Str. State of Ohio	Damaged her rudder; repaired at Cleveland	Port Stanley, Lake Erie.
Aug. 21	Str. Toltec	Sprung a leak and was run into Duncan Bay, below Cheboygan	Lake Michigan.
Aug. 22	Str. Francis Robbins	Storm blew hoisting apparatus and part of upper unloading frames over deck of steamer, damaging her decks and hatches; repairs estimated at $2,500; repaired at Manitowoc	Manitowoc, Wis.
Aug. 23	Str. John D. Ketcham	Carried away three gates of Lock No. 6	Welland canal.
Aug. 24	Str. Col. J. M. Schoonmaker	Struck Crib No. 4 and sprung 13 plates; docked at Lorain; repairs estimated at $15,000 and completed Sept. 2	West Neebish Cut.
Aug. 23	Str. Tacoma	Burned to water's edge and sank; total loss	Ludington, Mich.
Aug. 24	Str. E. B. Osler	Grounded; released on Aug. 25 after lightering part of coal cargo, which was reloaded	Winter Point.
Aug. 24	Str. Arrow	Broke her crank pin	Lake Erie near Put-in-Bay.
Aug. 24	Str. Joe S. Morrow	Ran aground; released on Aug. 25 and patched up at Sault; docked at Toledo Aug. 31; 31 plates damaged	Canadian side, Soo.
Aug. 24	Str. Doric	Collided with Str. A. McVittie; Doric's anchor was pushed through her hull and about 20 plates damaged	Soulanges canal.
Aug. ..	Str. Francis Widlar	Picked up a log and was docked at Cleveland Aug. 25 for repairs to her shoe, rudder and wheel	
Aug. ..	Str. Steelton	Hit a bridge which damaged her stern	St. Lawrence river.
Sept. 1	Str. City of Chicago	Damaged by fire shortly after leaving Chicago; repairs estimated at $50,000	
Sept. 2	Str. Easton	Broke her low pressure piston; towed to Duluth; out of service for a week	Lake Michigan.
Sept. 3	Str. Canisteo	Ran aground; steam pipe broke	Two Harbors, Minn.
Sept. 6	Tug Annie	Slightly damaged by fire; repairs cost $100	Near Middle Isl., Lake Erie.
Sept. 7	Str. Montana	Burned to water's edge and sank; valued at $12,000 and was partly insured; crew escaped; probably total loss	Sandusky, O.
Sept. ..	Str. Fordonian	Ran ashore; leaked slightly; stopped at Montreal	Lake Huron.
Sept. ..	Str. Forest City	Damaged by hitting concrete pier	Lachine Lake.
Sept. 9	Str. R. B. Hayes	Damaged by fire	Fort William, Ont.
Sept. 10	Str. Olcott	Collided with Str. Uhrig while leaving port; small dent in bow; repaired at Conneaut	Houghton, Mich.
Sept. 11	Str. Manola	While being towed out, ran afoul of tow line from tug; was released from wheel and no damage done	Conneaut, O.
Sept. 13	Fish Tug Ora Endress	Turned turtle and while being towed to Grand Marais sank to bottom; valued at $5,000	Conneaut, O.
Sept. 15	Str. W. L. Brown	Ran aground; released same day, without lightering	Whitefish Point.
Sept. 15	Str. J. G. Butler	Grounded owing to low water	Grosse Point, Detroit river.
Sept. 16	Str. Stormount	Ran ashore; released and went to Kingston for repairs	Entrance to Indiana Harbor.
Sept. 17	Bge. Santiago	Took a sheer when her steering gear broke and ran on west bank; released after lightering	Lake St. Louis.
Sept. 18	Str. Midland Prince	Collided with Str. C. W. Watson; docked at Port Arthur Oct. 1; five damaged plates	Livingstone channel.
Sept. 18	Str. C. W. Watson	Collided with steamer Midland Prince; repaired at Superior shipyard; repairs cost about $10,000	Livingstone channel.
Sept. ..	Str. J. H. Plummer	Ran ashore; docked at Buffalo for repairs	Livingstone channel.
Sept. 18	Str. Port Colborne	Struck, damaging nine plates; docked at Buffalo for repairs	Near Kingston, Ont.
Sept. 18	Str. Geo. F. Baker	Stranded in fog; released on Sept. 20 after jettisoning 400 tons of ore	Niagara river.
Sept. 20	Str. D. G. Kerr	Collided with Str. J. C. Ford in fog owing to misunderstanding of signals; several plates and frames bent	Lake Michigan near Chicago.
Sept. ..	Str. Arabian	Ran ashore; released, reloaded lightered cargo and went to Kingston	Near Soo.
Sept. 24	C. F. M. & B. No. 2	Main steam pipe burst, killing one man and badly scalding another; repaired at Conneaut	Moin Duck Island.
Sept. 24	Str. Presque Isle	Struck at entrance to canal and damaged her wheel; released on Sept. 25 after lightering large part of her coal cargo	Lake Erie.
Sept. ..	Str. Toiler	Ran ashore	St. Clair Ship canal.
Sept. 24	Dredge Fraser	Burned to water's edge at her winter moorings; valued at 50,000; partly insured	St. Lawrence river.
Sept. 24	Str. H. D. Goulder	Struck; docked at Superior Oct. 2; 19 plates taken off	Pelee Isl., Lake Erie.
Sept. 26	Str. Myron	In a mix-up with steamers Trimble and Cornelius; little damage done	Sandusky.
Sept. 27	Str. B. F. Berry	Ran aground owing to deranged steering gear, and put a buoy out of commission; released by tugs	Lower end St. Clair cut.
Sept. ..	Str. Queen City	Lost an anchor at Presque Isle ore dock	Head of Livingstone channel.
Sept. 29	Str. John Harper	Burned to water's edge	Marquette, Mich.
Sept. 29	Bge. Mary N. Bourke	Burned to water's edge and sank	Detroit river.
Oct. 4	Str. A. S. Upson	Ran aground in dense fog; released	Detroit.
Oct. 5	Str. A. C. Dustin	Ran ashore in smoke; released on Oct. 6 after lightering part of cargo	Cedar Reef, Lake Superior.
Oct. 7	Str. Neptune	Ran aground in turning around in fog; released on Oct. 8 after lightering about 100 tons of ore; reloaded lightered cargo	Near Mackinaw City.
Oct. 7	Tug Advertiser	Destroyed by fire which started in engine room; total loss	Marine City, St. Clair river.
Oct. 11	Str. D. Z. Norton	Collided with Str. W. C. Agnew; damaged to the extent of $2,000 or $3,000; docked at Cleveland Nov. 13; 7 plates taken off and considerable internal damage. Str. Agnew slightly damaged	Niagara river, off Lower Grand Island.
Oct. 12	Str. Princeton	Sprang a leak in port boiler; stopped at Soo for repairs	Lake St. Clair.
Oct. ..	Str. Quebec	Damaged in collision with Str. W. H. Dwyer; will make repairs at Sorel	Lake Superior.
Oct. 13	Str. Bulgaria	Sprang a leak and seams opened in heavy sea; beached; released and taken to Detroit by a tug; deck-house amidships badly smashed. United Fuel & Supply Co. bought coal cargo from underwriters	
Oct. 15	Str. North Sea	Hit a dock and stripped three buckets off her wheel	Near Point Pelee, Lake Erie.
Oct. 16	Str. Superior City	Got a line in her wheel and diver had to be summoned to remove same	Old Riverbed, Cleveland.
Oct. 17	Str. James C. Wallace	Broke bucket off her wheel while leaving port	Off Algonac, Mich.
Oct. 19	Str. Adriatic	Collided with Str. Wyandotte; repaired at Cleveland; 3 plates damaged which had to come off and new hawse pipe installed	Two Harbors, Minn.
Oct. 19	Str. Wyandotte	Collided with Str. Adriatic; bent in just aft of No. 1 tank; went to Ecorse for repairs; 29 plates damaged	St. Clair river.
Oct. 19	Str. A. S. Upson	Grounded on east bank just below the dyke in fog; released on Oct. 20; several plates damaged on port bow and several buckets stripped off her wheel	St. Clair river.
Oct. 20	Str. Griffin	Grounded; released by tug without lightering	Livingstone channel.
Oct. 20	Str. Schoolcraft	Ran ashore in dense fog; released and proceeded	Ballard's Reef, Detroit river.
Oct. 20	Str. R. L. Fryer	While being taken to a Lake Superior port for rebuilding, steamer was caught between submerged pile and wreck of Str. Tampa; released and taken to a Canadian yard to be rebuilt. (Fryer was partially destroyed by fire in spring of 1914)	Lake Huron, off Port Hope.
Oct. ..	Bge. Eleanor	Sank; floated	Marine City.
Oct. ..	Str. Breton	Struck	Livingstone channel.
Oct. 26	Str. Cuyler Adams	Ran aground; released after lightering 400 tons of coal and proceeded	Below Port Royal Dock, Soo.
Oct. 28	Str. Samuel Mather	Ran on bottom owing to low water caused by high wind; floated	St. Clair river.
Oct. 28	Str. Gen. Garretson	Grounded owing to low water; released, uninjured	Toledo, O.
Oct. ..	Str. Beaverton	Ran aground at entrance to canal; released by tugs	Mouth of Detroit river.
Oct. 29	Bge. Tyrone	Hit a bridge, damaging it to extent of $8,000; (In tow of Str. Lackawanna)	Iroquois canal.
Oct. 29	Str. Arthur Orr	Twisted her rudder stock	Toledo.
Oct. 29	Str. R. R. Rhodes	Picked up in disabled condition by Str. Colonial and towed to Charlotte, Mich.	Chicago.

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